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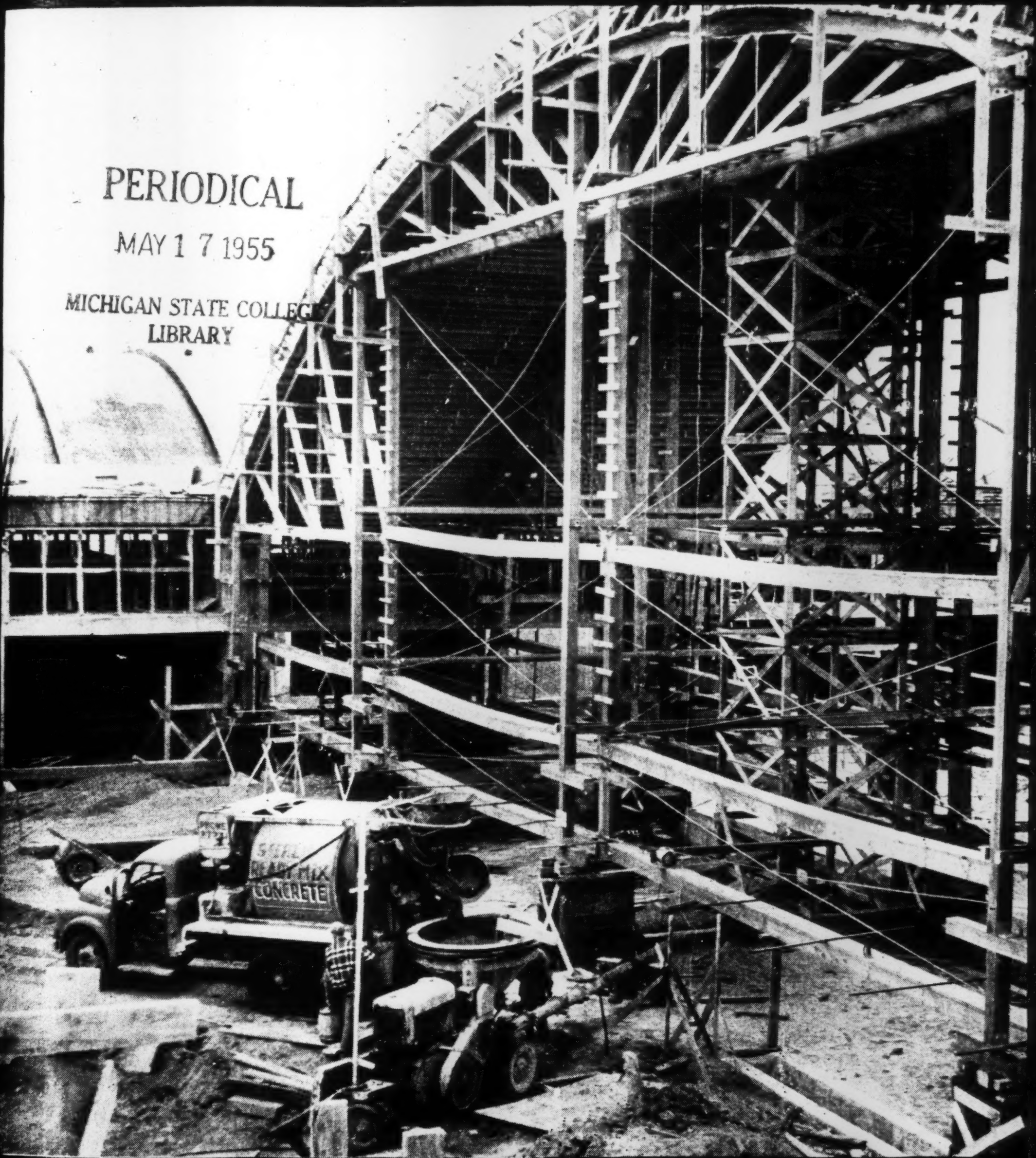

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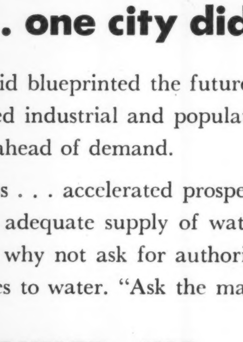

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MAY 1955
VOL. 25 • NO. 5

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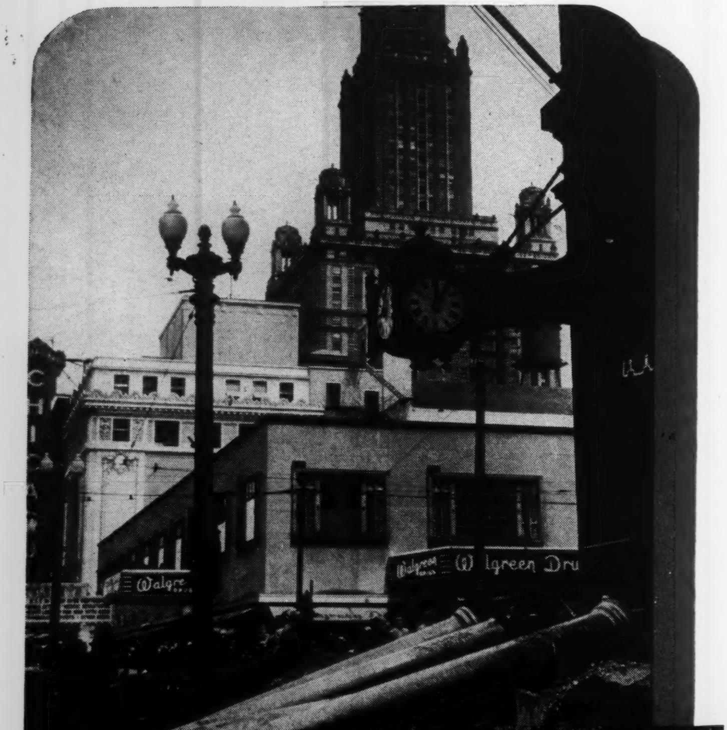

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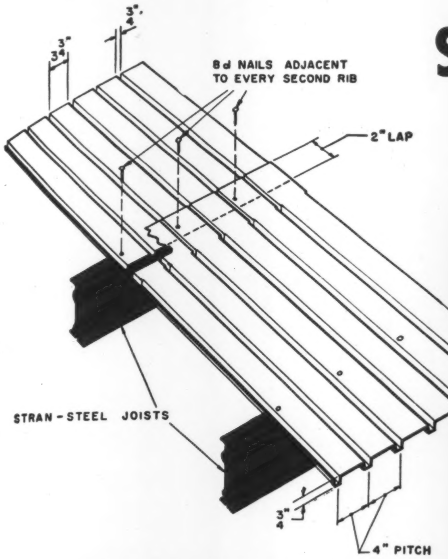

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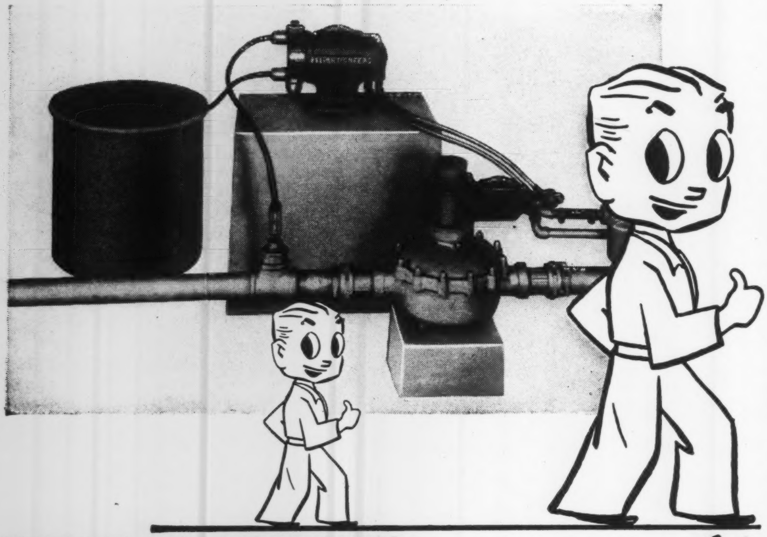
NEWS OF ENGINEERS

Herman W. Schull, Jr., Colonel, Corps of Engineers and Jacksonville District Engineer since 1952, has been named Lieutenant Governor of the Canal Zone Government with headquarters at Balboa Heights. A native of Philadelphia, Colonel Schull, was graduated from the United States Military Academy in 1927 and in 1929 received a C.E. degree from Cornell University. From 1947 to 1950 he served as adviser on military engineering to the Chief of Staff of the Peruvian Army at Lima and then became district engineer at Buffalo, N.Y.

William P. Curlin, commissioner of the Kentucky Highway Department, Frankfort, has joined the Kentucky Concrete Pipe Company at Frankfort.

William H. Adams has retired as research engineer for the Great Lakes Steel Corporation at Ecorse, Mich., to resume private consulting practice in Detroit. For the past twelve years Mr. Adams has been engaged in the company's development work in the light-gage cold-formed structural industry.



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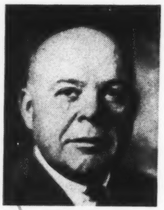
Kirby Smith, Rear Admiral, Civil Engineer Corps, USN, (Ret.), has retired as vice-president of domestic sales for the Raymond Concrete Pile Company in New York City. He has been with the company since 1926 except for four years wartime service as director of construction for the Navy Bureau of Yards and Docks. Mr. Smith has been a Director of ASCE and chairman of the Executive Committee of the Construction Division and co-chairman of the ASCE-AGC Joint Cooperative Committee.



Kirby Smith

Othmar H. Ammann, bridge designer and senior partner in the New York City consulting firm of Ammann & Whitney, received the 1955 Citizen and Engineering Award of the New Jersey Society of Professional Engineers at the Society's thirty-first annual convention held in Newark in April. Mr. Ammann is an Honorary Member of ASCE.

Robert C. Johnson, president of the Siesel Construction Co., Milwaukee, Wis., and widely known for his service in the South Pacific area in the U.S. Navy Sea Bees, has been named Engineer of the Year for 1954 by the Engineers' Society of Milwaukee. In 1953 the U.S. Senate confirmed his nomination as a rear admiral in the CEC of the Naval Reserve, making him the second man in the history of the Civil Engineer Corps to attain that rank. Two years ago the governor of Wisconsin appointed Mr. Johnson to membership on the Milwaukee County Expressway Commission.

Philip H. Perkins has resigned his post as deputy chief engineer (Water and Drainage) for the State of Kuwait to start a civil engineering consulting practice in Nicosia, Cyprus. He will specialize in water supply and drainage.

E. Alfred Picardi has joined the architectural and engineering firm of Bellman, Gillett & Richards, Toledo, Ohio, as an associate and chief structural engineer. Previously he was chief structural engineer for Kaighin & Hughes, Inc., in Toledo.

Dorothy A. Schoech, a graduate of the University of Missouri, recently began work as bridge designer for the Missouri State Highway Commission with headquarters at Carthage, Mo. She is the first graduate woman engineer to be employed by the Department.

[redacted]

Wendell E. Johnson, chief of the engineering division of the Corps of Engineers' Missouri River Division, is now consultant to the Canadian government on construction of an 8,500-ft-long earth dam on the Saskatchewan River, a power and irrigation project. ASCE Honorary Member **Karl Terzaghi** and **Arthur Casagrande,** soil mechanics and foundation specialists in the Harvard University Graduate School, have also been named consultants on the project.

Eric C. Molke and **Frederick E. Koebel** are associates in the recently formed firm, Prestressing Research & Development, Inc., with offices in the Transit Tower, San Antonio, Tex. The firm will provide consulting services for specialized applications of prestressing in either research and investigations or specific design projects. Mr. Molke, the new president, was formerly chief engineer of Preload Engineers of Arlington, Va., and Mr. Koebel, new vice-president, was research engineer of Southwest Research Institute, San Antonio, Tex. The other members of the new firm are **James Mennis** and **T. J. Gut.**

Wilbourne O. Jones, city manager of Fort Worth, Tex., since 1946, has become engineer-manager for Associated Turnpike Engineers which is working on the Fort Worth-Dallas Turnpike. Mr. Jones has served Fort Worth in various capacities for thirty-four years and was the city's "Engineer of the Year" in 1953.

Phillip Z. Kirpich, until recently resident manager for Knappen-Tippetts-Abbett-McCarthy in Athens, Greece, has left that city to accept a job as chief engineer for the Corporación Autonoma Regional del Cauca at Cali, Colombia. Under the terms of a contract between the Corporatión and three firms—Knappen-Tippetts-Abbett-McCarthy, Gibbs and Hill, Inc., both of New York, and Olarte, Ospina, Arias & Payan, Ltda., of Bogotá—the Corporatión is working on the development of Colombia's natural resources—a TVA type of development.

Mason G. Lockwood, partner in the Houston, Tex., firm of Lockwood & Andrews, has been honored by the San Jacinto Chapter of the Texas Society of Professional Engineers with the award, "Engineer of the Year." The award was given at the fifth annual award dinner in Houston on February 24. Mr. Lockwood is a Vice-President of ASCE.

Oliver G. Bowen recently received an honorable mention in the Architectural League of New York's 1955 contest for his parking terrace in Salt Lake City. Awards were presented at the 58th Annual Gold Medal Exhibition and Dinner held on March 17. Mr. Bowen is senior partner of Bowen, Rule & Bowen, Los Angeles.

(*Continued on page 22*)

Setting steel tunnel supports with hydraulic jacks saves time and money...

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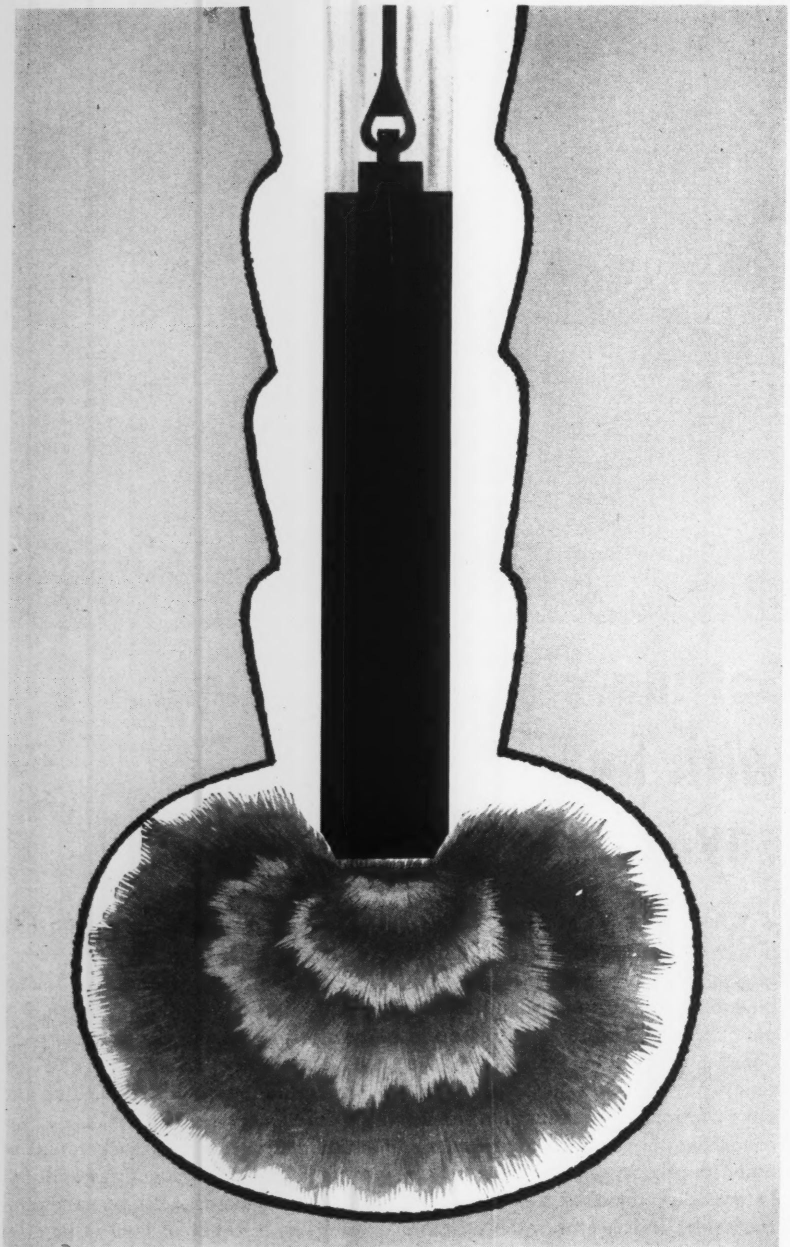

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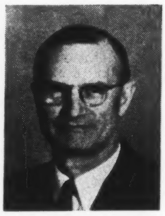
News of Engineers

(Continued from page 21)

Claude T. Wilson, for the past six years real estate officer of the Colonial Trust Company, at Waterbury, Conn., retired in January after twenty years of service with the bank. Mr. Wilson graduated from Massachusetts Institute of Technology in 1909 and then worked on two tidewater Company projects at Naugatuck, Conn. He has also been with the Turner Construction Company and the Ferguson Company.



Charles D. Curtiss

Charles D. Curtiss, since 1943 deputy commissioner of Public Roads, has been made commissioner in charge of directing the work of the Bureau of Public Roads. An engineering graduate of Michigan State College, Mr. Curtiss has been in the Bureau of Public Roads since his separation from military service at the end of World War I. For a number of years he was in charge of its finance and management activities. Long active in ASCE, Mr. Curtiss was secretary of the Highway Division for twenty-five years. He is also a past-president of the National Capital Section.

Thomas F. Thompson has resigned as division engineering geologist, South Pacific Division, Corps of Engineers, to accept employment with the Ralph M. Parsons Co., of Los Angeles. He will be resident engineer for the company's contract with the government of India to provide consulting and technical services for new ground water supplies throughout the country.

William J. Van London, engineer-manager of the Texas State Highway Department, Houston, has retired. Mr. Van London has been with the Department since 1921.

Carlos A. Weber, assistant chief engineer of the Michigan Highway Department, has been promoted to deputy commissioner-chief engineer, the position held by the late **Harry C. Coons** (see Deceased, page 94). Mr. Weber has been with the department for thirty-five years and is a graduate of Michigan State College.

Elmer B. Greey, formerly deputy director of the Atlantic Division of the Navy Bureau of Yards & Docks, has been assigned to the Joint Construction Agency, United States European Command, as chief of the engineering division. He succeeds **Daniel B. Ventres,** Captain, Civil Engineer Corps, who is retiring. For a number of years Captain Greey was vice-president of the Matthews Construction Co., Princeton, N.J.

Julian R. Fleming assumed duties as director of the Division of Sanitary Engineering in the Tennessee Public Health Department on March 21. A graduate of the University of Tennessee, Mr. Fleming has been connected with the university since 1935. Since 1946 he has been associate professor in charge of hydraulic and sanitary engineering. His headquarters will be in Nashville.

Albert L. Winkler, who was promoted to the rank of lieutenant colonel in the U.S. Air Force on March 16, has been assigned to work with the Installations Engineer for Goose Bay, Labrador. With the military reserves since 1932, Colonel Winkler has served the past four years as Sacramento District Operations Officer of the Air Force's Installations Representative Office, South Pacific Region, in San Francisco.

Robert R. Harris, sanitary engineer director and chief of the Water Pollution Control Basin Office of the Public Health Service in Portland, Oreg., since 1949, became chief of the Water Supply Branch, Division of Sanitary Engineering Services, in the Washington headquarters on March 1. Mr. Harris joined the Service in 1948. **Alfred H. Wieters,** assistant chief of the Water Pollution Control Program, left Washington on April 21 to become a consultant to the Ministry of Health in Rio de Janeiro, Brazil, where he will advise on legislative, technical, and administrative problems in a national water pollution control program. He has been in the Public Health Service since 1946.

Charles E. McGraw has been appointed vice-president and general manager of the Marcona Mining Company in Lima, Peru. This is a subsidiary company of the Utah Construction Company of San Francisco, for which Mr. McGraw was project manager on construction at the Marcona mine at San Juan, Peru.

John B. Howe, associate and field engineer in the firm, Maurseth & Howe of Los Angeles, announces the removal of their offices to 2601 South Hill Street, Los Angeles. The firm specializes in soil and foundation engineering.

Stewart Mitchell retired on March 31 as principal bridge engineer in the Bridge Department of the California State Division of Highways after thirty-one years' service. Mr. Mitchell is a graduate of Purdue University and veteran of World War I, and had been in the Division of Highways since 1924.

Jean Paul Carriere, chief engineer of the Dufresne Engineering Co., Montreri, Canada, has been appointed chief engineer of the harbors and rivers engineering division of the Canadian Federal Works Department.

Harold E. Sprague, Lieutenant Colonel, Army Corps of Engineers now stationed in the Far East Command, will become district engineer at Pittsburgh, Pa., in July.

© Fabian Bachrach

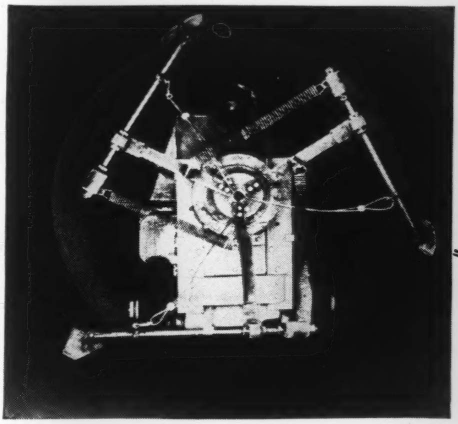
T. E. Smith

Thornton E. Smith, formerly of the Industrial Engineering Company, has been elected secretary-treasurer of Kuhn, Smith & Harris, New York City commercial construction firm. Mr. Smith is a graduate of Massachusetts Institute of Technology and the Harvard Business School.

Albert C. Bux of Omaha, Nebr., has retired after approximately thirty years with the Corps of Engineers on flood control, river regulation, and military activities. A retired Army major, Mr. Bux served with the A. E. F. in France in World War I, and in Post Engineer duties in the recent war.

Philip S. May began duties as assistant engineer for Hamilton Township, N.J., on March 1. Mr. May was previously consulting engineer with Parson, Brinckerhoff, Hall & Macdonald of New York City.

(*Continued on page 24*)



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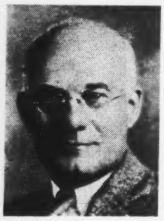
News of Engineers

(*Continued from page 23*)

Frank H. Neison, formerly civil engineer and assistant chief of the Engineering Design Branch of the National Park Service's Planning and Construction Division in Washington, D.C., has assumed duties as maintenance engineer in the Maintenance Division, Director of Facilities Support, Assistant Chief of Staff Installations, Headquarters, U.S. Air Force, Washington 25, D.C.

Cherry L. Emerson, vice-president of the Georgia Institute of Technology, will retire June 30. Mr. Emerson was dean of engineering before heading the Institute's construction program.



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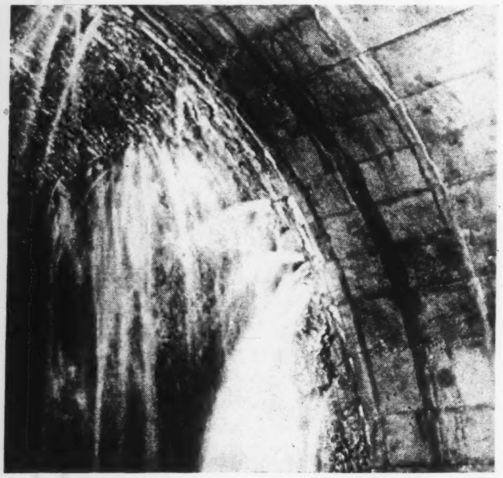
H. A. Saurbrey

Henry A. Saurbrey was elected a member of the Board of Directors of the Mellon-Stuart Company, Pittsburgh contracting engineering firm on April 7. He has been an executive vice-president of the company since last September and has been connected with the company since 1949. He was chief construction engineer for the Westinghouse Electric Corporation.

SIKA



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Vincent V. Malcom, formerly department manager of the Philip Carey Manufacturing Company of Lockland, Ohio, was appointed vice-president and general manager of the Perrault Equipment Company of Tulsa, Okla., on March 1. Mr. Malcom had been with the Carey company since 1927.

James C. Marshall, Brigadier General, Corps of Engineers, (ret.), has recently joined the staff of Knappen-Tippetts-Abbett-McCarthy, Engineers, as engineer consultant in connection with the firm's contract with the United Nations Korean Reconstruction Agency. Until recently General Marshall was director of operations for the Koppers Company contract at Zonguldak, Turkey. His headquarters will be in the United Nations Building in New York.

George E. Hubbell, Albert Roth and **Homer W. Clark** announce the removal of their consulting firm, Hubbell, Roth & Clark, Inc., to 954 North Hunter Boulevard, Birmingham, Mich. The office was formerly in Detroit.

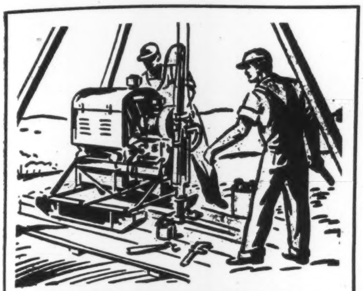
Gordon E. McCallum, sanitary engineering director of the U.S. Public Health Service, Department of Health, Education, and Welfare, will head the Service's Water Pollution Control Program in Washington. Mr. McCallum, chief of the Office of Health Emergency Planning since 1951, has been a career sanitary engineering officer of the Service for the past twenty years and has filled engineering assignments in many field offices.

James Ray Heath, partner in the engineering firm of Heath, Hammond, Collier & Associates, has been appointed water superintendent for Seattle. Mr. Heath was formerly president of the General Engineering Company, Inc., Seattle.

Alvin F. Meyer, Jr., Lieutenant Colonel, U.S. Army, chief of the Preventive Medicine Branch, Headquarters Strategic Air Command, was presented the U.S. Air Force's Commendation Ribbon by General LeMay, SAC Commander, on March 16 at SAC headquarters in Omaha, Nebr. Colonel Meyer was cited for his service in the Preventive and Industrial Medical Branch of the Air Materiel Command, from 1948 to 1954.

Orson W. Israelsen arrived in Roorkee, India, in February, to set up a post-graduate course at Roorkee University for irrigation engineers. Professor Israelsen, who is a consultant to Agricultural Development & Engineering Services, Inc., Logan, Utah, expects to be at Roorkee University for a year.

Charles F. Mitchim, Colonel, Corps of Engineers, secretary of the Mississippi River Commission and assistant division engineer for the Lower Mississippi Valley



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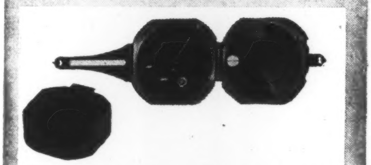

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Division, Vicksburg, Miss., will be transferred to Supreme Headquarters, Allied Powers in Europe in June. Colonel Mitchim will be chief of the Land and Naval Installations Section in the headquarters of General A. Gruenther, SHAPE Commander in Paris.

R.H. Dodds

Robert H. Dodds has joined Lockwood, Kessler & Bartlett, Inc., consulting engineering firm of Great Neck, N.Y., as development engineer. Mr. Dodds has been associate editor in charge of contracting and heavy construction with *Engineering News Record* since 1948. From 1946 to 1948 he was an associate professor at Colorado A. & M. College.

Richard E. Burnett is leaving the Bureau of Reclamation, for which he was resident engineer on the Ventura River project in California, to become reservoir construction manager for Uhl, Hall and Rich of Boston, engineers for the New York State Power Authority on the St. Lawrence Power Project. Mr. Burnett has been with the Bureau of Reclamation for nineteen years—for five years as chief of the construction division on the Cachuma Project in California. He is currently president of the Santa Barbara Ventura Counties Branch of the Los Angeles Section.

Benjamin B. Talley, Brigadier-General, U.S. Army and division engineer of the North Atlantic Division of the Corps of Engineers, recently received his general's insignia in a brief ceremony at Division headquarters in New York. General Talley's promotion was recently confirmed by the U.S. Senate. He is chairman and Department of the Army representative on the New England-New York Inter-Agency Committee which is conducting a thorough resources survey of the Northeast region.

Carroll H. Dunn, Colonel, Army Corps of Engineers, will become Executive, Office of the Chief of Engineers, on July 18. Colonel Dunn has been director of the Waterways Experiment Station at Vicksburg, Miss., since 1952. He will be succeeded as director by **Col. Andrew P. Rollins, Jr.,** now assistant district engineer at Albuquerque, N. Mex.

Anton Tedesko, recently manager of structures for Roberts and Schaefer Co. in Chicago, has assumed similar duties in the New York office of the company and will also share in the management of Thompson-Starrett Engineering Associates, Inc. Since 1953 he has been a Director of the Illinois Section.

(*Continued on page 102*)

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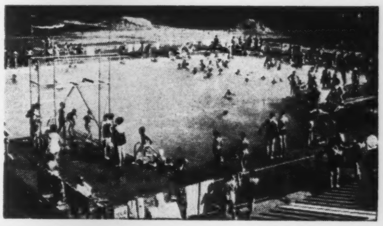

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Combining 25,000 gallons of water storage for regular use with a fixed reserve of 75,000 gallons for sprinkler demand, this 100,000-gallon Pittsburgh-Des Moines Double-Ellipsoidal Elevated Steel Tank is of a type and size widely favored by industrial plants, hospitals, institutions and smaller communities.

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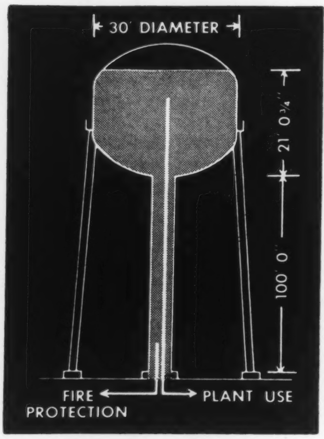

Diagram illustrates plant-use storage down to 75,000 gallon level. Balance of tank and riser capacity reserved for fire protection only, supplying automatic sprinkler system.

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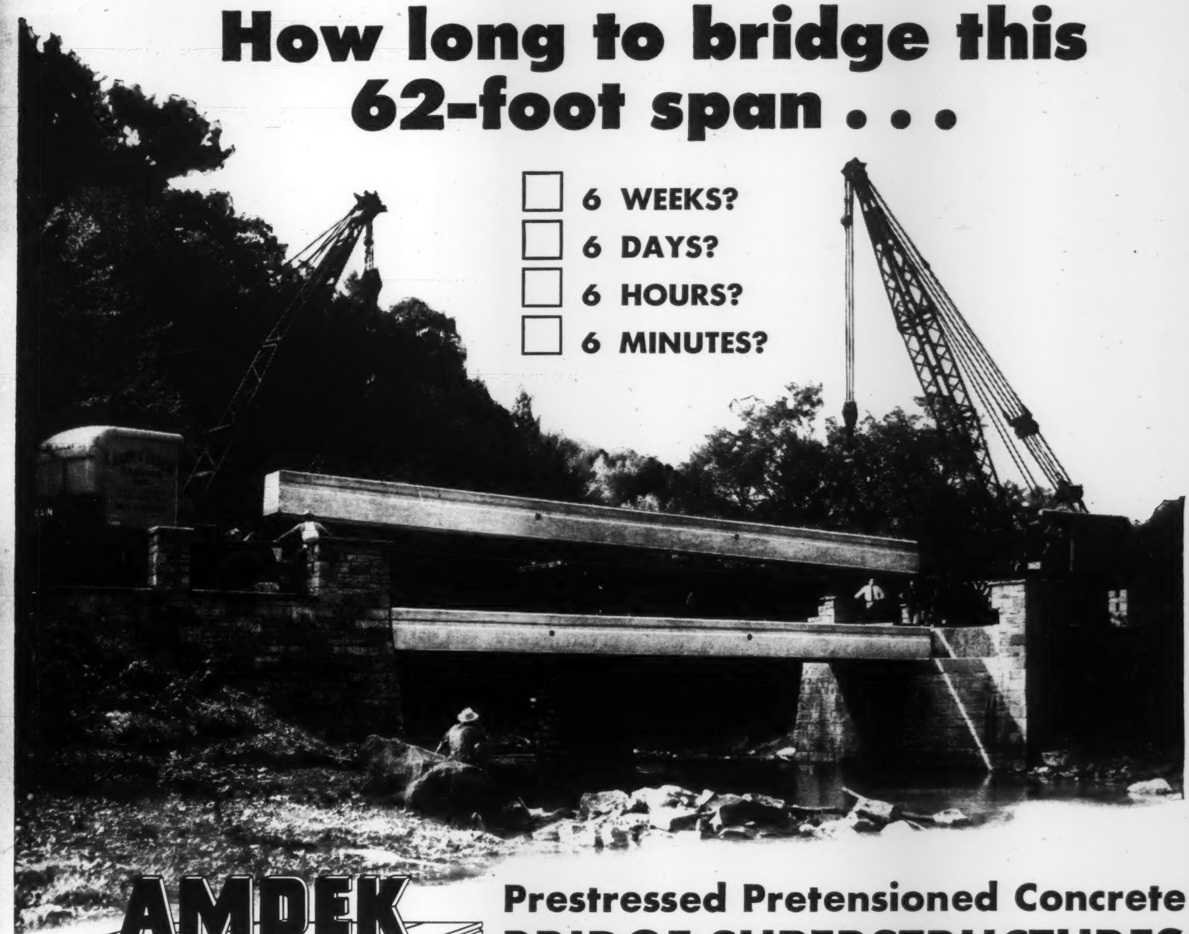

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6 HOURS! That's the remarkably short time it took a few workmen to span Laurelhill Creek near Somerset, Pennsylvania with the longest prestressed bridge in the state. Seven "factory-built" AMDEK sections were swung by cranes into position on offsets built into the old bridge abutments. After a few finishing touches, the bridge was ready for use!

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170 cu. yds. per hour on 1600-ft. cycle

Tulsa contractor averages 170 cu. yds. hourly with TD-24s and B-250 INTERNATIONAL scrapers on 1600-ft. cycle while helping cut 24 per cent off length of Oklahoma highway

The D. W. Falls Construction Company of Tulsa holds the prime grading contract for 7.6 miles of Oklahoma State Route No. 20 between Hominy and Ralston. They were able to make cost-cutting short cuts in earthmoving operations on the project that cut travel distance 24 per cent by using three INTERNATIONAL TD-24 drawn B-250 scrapers moving 27 cubic yard-heaped loads, and push-loaded by a TD-24 crawler.

Take it from Supt. Bob Derington:

"It's really surprising how much dirt these big scrapers will move per day. Under fairly good working conditions, each unit gives me a day-after-day average of 170 cu. yds. of dirt an hour while working a 1,600-foot cycle."

You can get pay-off performance by hitching INTERNATIONAL scrapers to the TD-24—still the Champ of the crawlers with 161 drawbar horsepower. That's the kind of hook-up that loads, hauls and spreads faster than any other combination . . . day after day . . . year after year. Just call your INTERNATIONAL Industrial Power Distributor for demonstration proof. He'll bring the combination you specify anywhere, anytime so that you can see why INTERNATIONALS make every load a payload.

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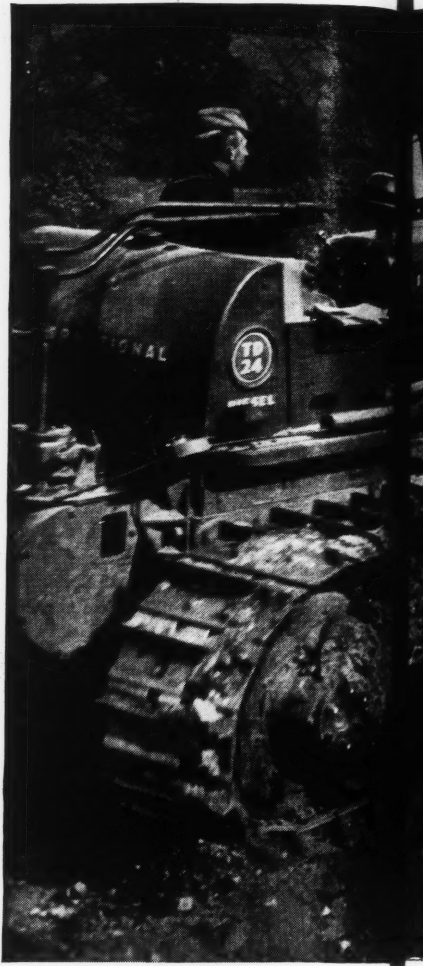
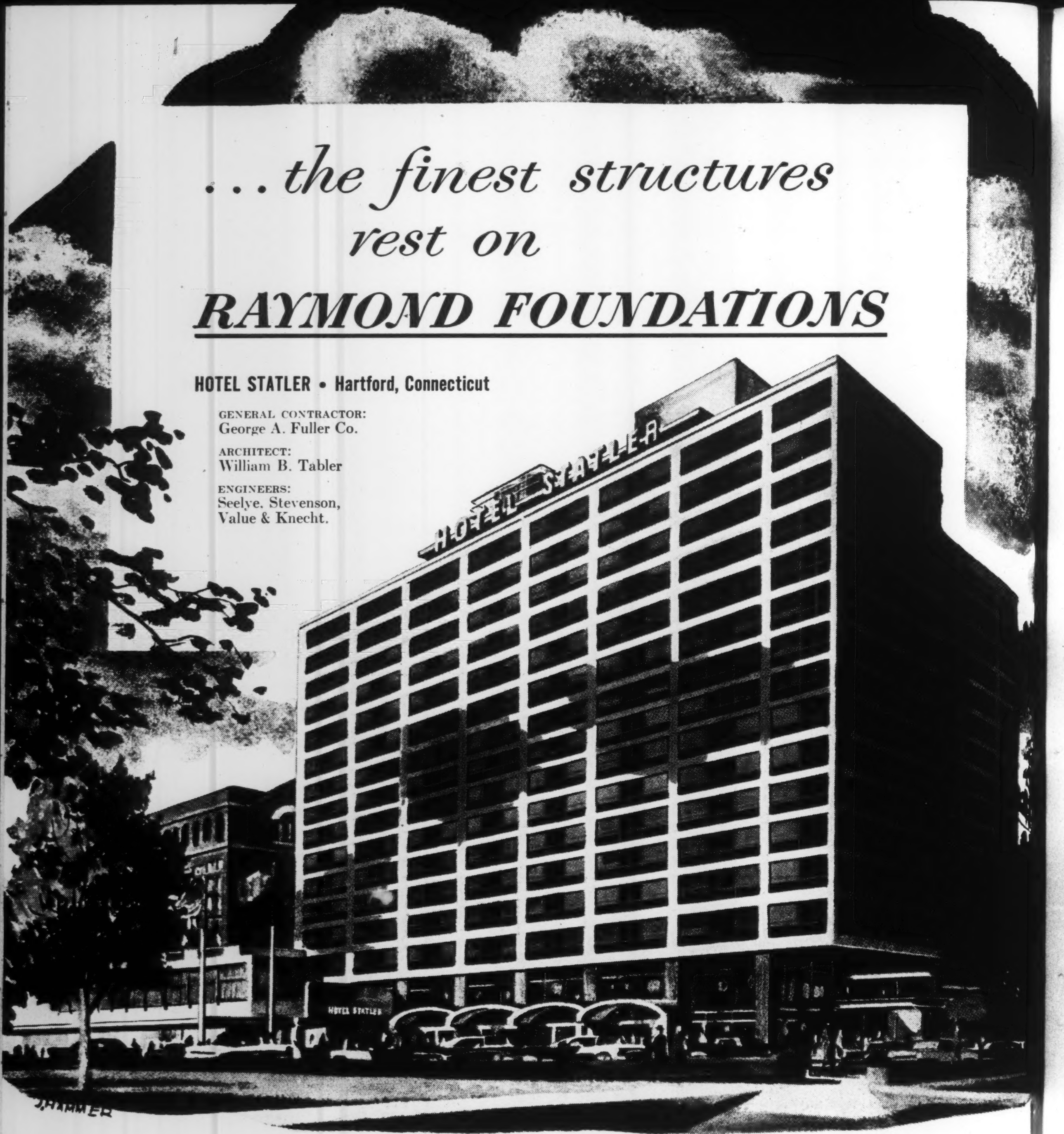


SMOOTH-WORKING TEAM. Four INTERNATIONAL TD-24 crawlers and three B-250 scrapers delivered a total of 510 cu. yds. hourly on the 1,600-foot cycle for D. W. Falls.

INTERNATIONAL

TD-24 POWER FRONT AND BACK PUTS these kinds of 27 cu. yd.-heaped loads in the INTERNATIONAL B-250 scraper in a matter of seconds for D. W. Falls on the company's 7.6-mile project requiring 250,000 cu. yds. of excavation.

EASY, FAST HAULING of heaped loads is assured with this equipment combination. The B-250 scraper requires minimum drawbar pull and has a low center of gravity that gives outstanding stability on side slopes like this.



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Panama Canal capacity is being increased? Recently completed modernization work on the Gatun Locks has raised the daily capacity of the Canal from 23 to 29 seagoing ships while either of the two lock lanes is being overhauled (a frequent procedure). Other projected improvements are expected to raise the normal capacity of the waterway to 54 seagoing ships in a 24-hour period of operation.

New York City is about to embark on a $140 million water project? An appropriation of $85.3 million has been earmarked for getting construction started on the Cannonsville dam and tunnel project, the third and final stage of the city's program for developing its Delaware River water supply system. It is estimated that with the Cannonsville Project the city's water needs will be satisfied up to the year 2000.

Reduction of bridge clearances may save the public money? The cost of providing navigational clearances in the construction of existing bridges is estimated at $754 million in the lead article in this issue, which reports cost data based on a Department of Commerce study of over 2,000 bridges. Retractable projections for water craft are seen as one solution to this economic problem.

Private groups are rushing to build atomic plants? Private and public utility groups all over the country are forming combines to build nuclear reactor plants for production of electric power for peacetime uses. Other groups are waiting for a green light from the Atomic Energy Commission (page 85).

Competition for work on the St. Lawrence Power Project is exceptionally keen? With contractors shaving their bids to get the coveted jobs on the mighty seaway and power project, the successful joint venture for construction of Long Sault Dam was low bidder by less than one-tenth of 1 percent (page 83).

A history is available on UET, titular owner of our headquarters building? A 50-page pamphlet giving the history of United Engineering Trustees, Inc., and the background of the Carnegie-financed headquarters building will be of special interest now. It may be obtained without charge from UET Secretary John H. R. Arms, 33 West 39th Street, New York 18, N.Y. A site for the new Engineering Societies Center Building has not yet been chosen (page 72).

Construction continues to climb? The Departments of Commerce and Labor place the value of new construction put in place in March at $2.9 billion, which sets a new high for the month and closes out the most active first quarter on record. Their analysis appears on page 82.

An atomic locomotive is being studied? A contract for the first study in our history of a nuclear-power reciprocating engine for locomotive propulsion was signed in March. Parties to the contract are the Atomic Energy Commission, the Denver and Rio Grande Western Railroad, and the Baldwin-Lima-Hamilton Corporation.

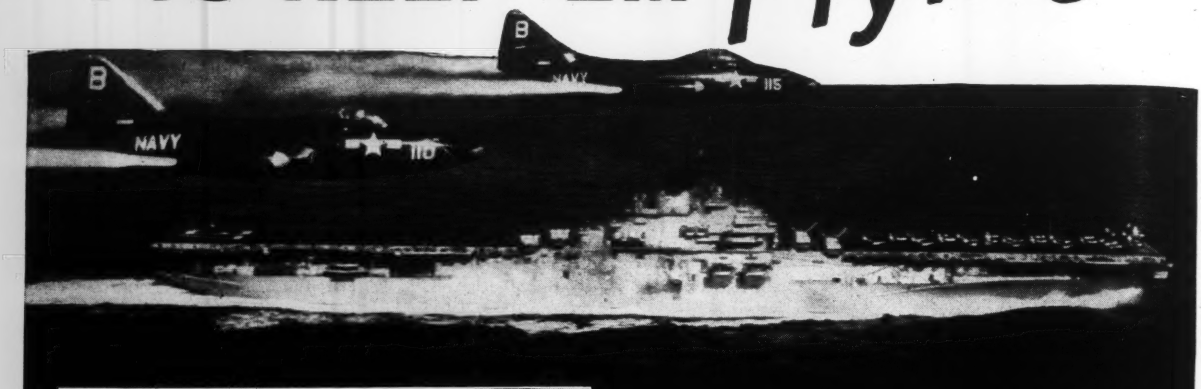
Quenching the steel industry's thirst requires water at the rate of 6,000,000 gal per min? The American Iron and Steel Institute says that in 1953, the year of greatest steel production, the industry used a total of 3,108 billion gallons of water, of which 55 percent was recirculated back into surface water sources.

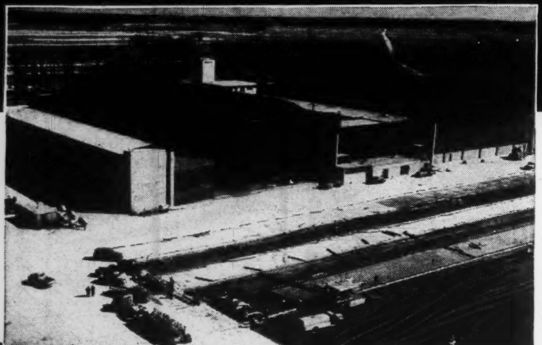
Thin-shell dome construction can be studied first hand at the St. Louis Convention? Topping an interesting list of planned tours will be the Lambert-St. Louis Municipal Airport, which features intersecting thin-shell concrete barrels. Another drawing card will be an afternoon session devoted to the eagerly awaited report of the Hoover Commission's Task Force Committee on Water Resources and Power. The full Convention program is printed in this issue.

The first Chief of Engineers is being honored? This May belated honors are being paid to Etienne Bechet Sieur de Rochefontaine, first Army Chief of Engineers, by the Society of American Military Engineers, which is dedicating a restored monument to him in St. Paul's Churchyard, New York, during its 35th annual meeting. Colonel Rochefontaine received his appointment under President George Washington in 1794.

Several new pieces of Society jewelry have been made available in the past year? Members wishing to order one of the various ASCE emblems on hand will find an order blank in the April issue (page 135).

TO KEEP 'EM *Flying*





Hollow, Precast Concrete Arch Ribs 164 Ft. Long Support Precast Thin-Shell Concrete Roof for Navy's Oceana, Va., Aircraft Maintenance Hanger

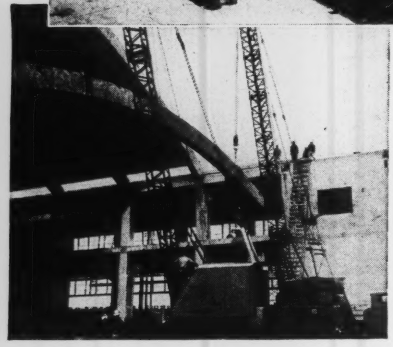
● Forward-looking in all of its operations, the Navy has been a pace-setter in precast concrete design, as illustrated by this $2.1-million, twin-barreled Aircraft Maintenance Hangar at U. S. Naval Air Station, Oceana, Va., one of the east coast master jet air bases where Air Groups who man our carriers are trained and their jets maintained at peak operational efficiency.

Each barrel is spanned by 12 hollow, precast, reinforced-concrete arch ribs, 164 ft. long, rising parabolically above heavy concrete abutment bents which also form the frame of the two-story office sections. Arch ribs were precast at job site in half sections, each 82 ft. in length, weighing 22½ tons. The half arches were hinged at each end, and after full dead load was applied, hinges were welded and concreted to form fixed ends.

The arches support the thin-shell concrete roof, consisting of 924 panels, 20 with sloping overhang, cast at the job site on concrete forms, using the Vacuum Concrete, Inc. method.

Precise casting and erection schedules resulted in assembly-line precision in building a hangar which admirably fits its purpose—with overall economies that merit the attention this type of advanced prefabrication is receiving from designers all over the country.

Lone Star is proud of the privilege of supplying 23,405 bbls. of cement for this outstanding project—quality cement, every barrel of it, as reflected in a finished structure of outstanding character.



Hollow precast arch ribs, each 164 ft. x 3 ft. x 1¾ ft., twelve for each hangar, were precast at job site. The precast, thin-shell roof consists of 924 panels, each 24 ft. long, 4 ft. wide, with ribs 10 in. deep and 1¼-in. shell.

U. S. NAVY AIRCRAFT MAINTENANCE HANGAR
Oceana, Virginia

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THE ENTIRE CONSTRUCTION FIELD

ARE HIGH NAVIGATIONAL CLEARANCES TOO COSTLY?

WALTER KURYLO

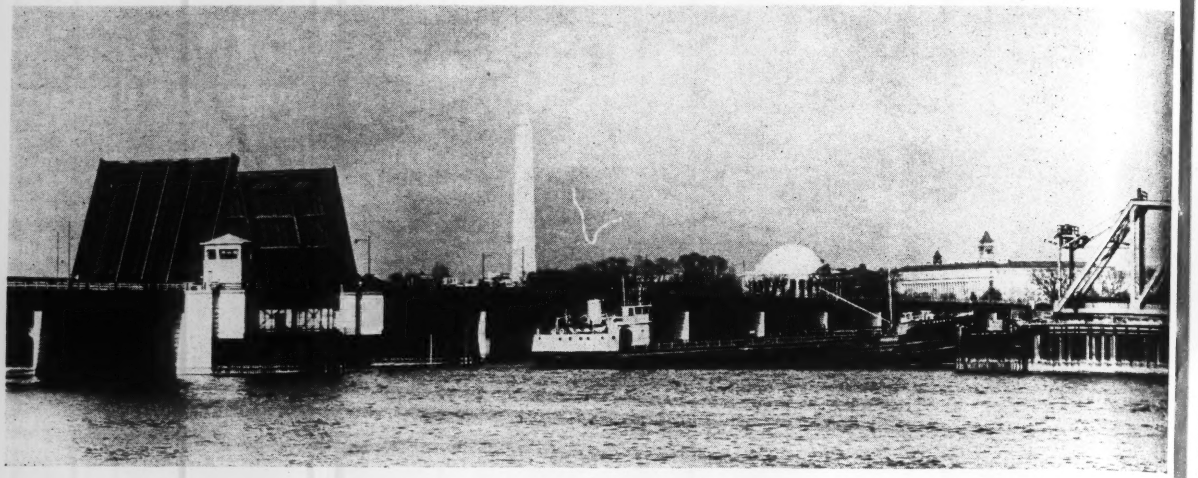
Administrative Officer, Bureau of Public Roads, Department of Commerce, Washington, D.C.

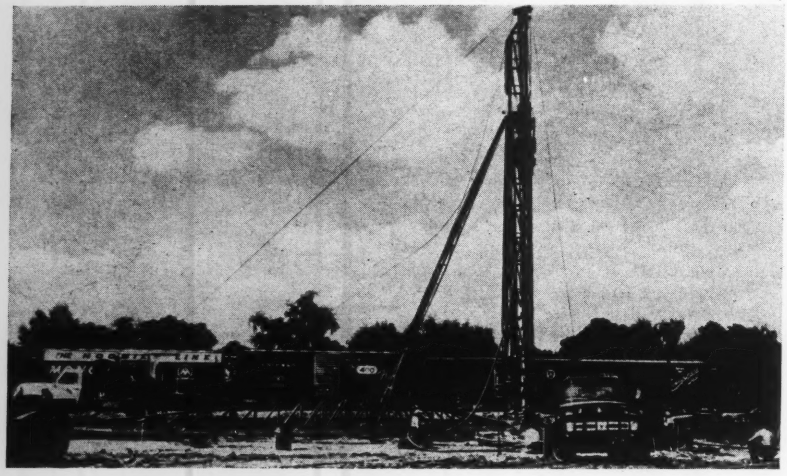
How much are overland transportation costs increased as a result of navigational clearances for bridges? A report of the Department of Commerce, Washington, D.C., entitled *Navigational Clearance Requirements for Highway and Railroad Bridges,* released in March of this year, answers that question very effectively. The cost of providing navigational clearances in the construction of existing bridges, as adjusted to 1950 price levels, is estimated at $754 million. About $17 million annually is expended in the operation and maintenance of bridges due to navigational needs, and the increased cost of vehicular and railroad traffic due to waterway requirements is no less than $11 million annually.

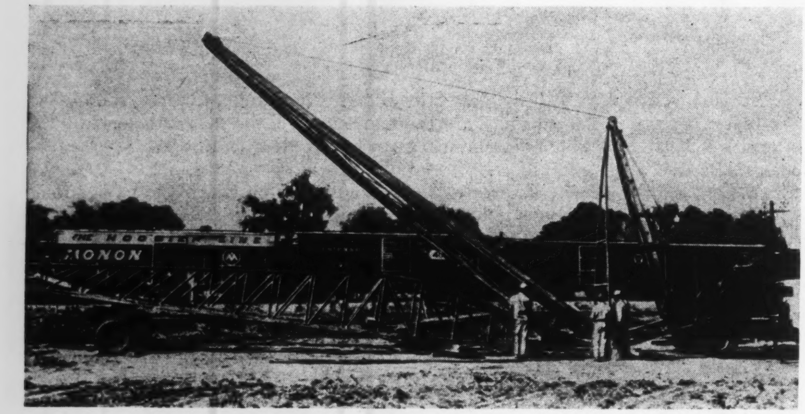
These cost data are based on the detailed study of 2,247 bridges. The totals are conservative, because only 95 percent of the highway bridges across navigable waterways, and only 50 percent of the railroad bridges in the same category, underwent a preliminary review to identify bridges for detailed analysis.

Structures excluded were those on which the navigational increment to the initial cost of construction was less than 5 percent of the total cost of the structure. Only a few joint highway-railroad bridges were studied. No effort was made

How much is the public paying to maintain high navigational clearances? Studies on North Fork of Chicago River indicate long-range savings of $6,750,000 resulting from switch to fixed bridges. In photo above, five bascules swing open to pass a naval vessel on the Chicago River.







to analyze cost on 48 federally owned structures. Tunnels under navigable waterways were excluded.

The report is based on the well-established premise that all transportation costs are ultimately borne by the general public in the form of cost of consumer goods, services, and taxes. It recognizes that our expanding economy is dependent for transportation needs not on our waterways alone, or on our railroads alone, or even on our highways alone, but on all three forms of transportation.

The significance of the high cost of providing navigational clearances is emphasized by a consideration of movable-span bridges. There are 2,188 movable-span bridges in the United States. Of this total, 1,465 have full-time attendants. Only 723 are operating on a limited basis under regulations issued by the Secretary of the Army.

At least 21 movable-span highway bridges in 13 states, and two movable-span railroad bridges, never have been opened for the accommodation of navigation. No less than 375 movable-span highway bridges located in 30 states and 179 movable-span railroad bridges are opened on an average of once a day or less. About 424 movable-span highway and railroad bridges have not been opened for a year or longer.

Overland transportation interests have been wondering for many years

On overland moves, tall equipment such as pile driver leads is demountable and can be lowered to conform to grade separation clearances. Why then must projecting masts and outriggers on ships be fixed?

Tanker seen in view at left required opening of four movable spans on Potomac River. Excluding the $3.5 millions (at 1950 price levels) of navigational increment in the first cost of these structures, it costs $1.43 per ton of waterway traffic along this reach to accommodate navigation. This includes cost to vehicular traffic of traffic jams such as that shown above caused by open bascule on Potomac River.

how the increased cost of specific bridges, arising solely from provisions to accommodate navigational needs, could be expressed in terms of cost of waterway traffic, and what the results would be. For the first time in American transportation history, the answers have been collected and reported, in the report by the Department of Commerce referred to at the beginning of this article. The examples cited in this report clearly demonstrate the nature and magnitude of the problem confronting the general public and the affected transportation interests.

A Maine bridge analyzed

The movable-span highway bridge about one mile from the mouth of the Kennebunk River, Maine, is an excellent example of the situation on a stream carrying a relatively small volume of waterway traffic. According to the annual reports of the Chief of Engineers, no waterway traffic was reported on the Kennebunk River before 1929. During the 24-year period beginning in 1929 and ending in 1952, a total of 3,363 ton-miles of waterway traffic was reported—an annual average of 140 ton-miles over that period.

In 1933, the Maine State Highway Commission constructed a swing bridge about one mile above the mouth of the river. The original cost of the bridge was $45,000. Of this, the amount required to meet navigational demands was estimated at $17,000, or 38 percent. Assuming a 70-year life for the bridge, the annual pro rata of that increment is estimated at $243, without interest. In addition, about $300 per year is required to maintain and operate the bridge to meet navigational needs. The cost of the vehicular delays that occurred during the 69 bridge openings for the accommodation of water craft during 1950 was about $43. This relatively insignificant annual cost of $43 for vehicular delays is not considered in the computations that follow.

By dividing the long-range annual average of waterway traffic, or 140 ton-miles, into the $543 of annual bridge costs mentioned above ($243 plus $300), a cost of $3.88 per ton-mile of waterway traffic is arrived at. By adjusting the bridge construction costs to 1950 price levels—which reflects a more realistic indication of current and future bridge costs due to navigational needs—and by following the same procedures, the average adjusted cost of providing a special clearance in this bridge for the accommodation of navigation becomes $7.24 per ton-mile of waterway traffic.

Bridges across the Potomac

Even where several bridges containing special provisions for navigation are involved, and substantially greater tonnages are carried on the waterway, the hitherto unevaluated overland transportation subsidy to waterway traffic assumes significant proportions. The bridge situation on the Potomac River in Washington, D.C., is an excellent example. There are four movable-span bridges across the reach of the river in question. One is a railroad bridge and the other three are highway bridges. The additional first cost required to provide for navigation through these structures, as adjusted to 1950 price levels, is estimated at more than $3.5 million. However this sum is *not* taken into account in the computations below.

The total annual cost of maintaining and operating these four bridges for the accommodation of navigation is estimated at $278,000. The annual vehicular and train operating differential on these bridges, resulting solely from navigation, is estimated at $50,000. Bridge openings are required almost entirely for the accommodation of watercraft hauling petroleum products. During the five-year period from 1948 through 1952, an annual average of 231,000 tons of petroleum products was transported on this reach of the river. By dividing these 231,000 tons into $328,000 ($278,000 + $50,000), a cost of $1.43 per ton of waterway traffic is obtained.

In its report, the Department of Commerce stated:

"In the public interest, before additional movable spans or high-level features are required in future bridges across this reach of the Potomac River for accommodation of navigational needs, every effort should be made to ascertain whether the overall savings in bridge costs—through provision of fixed bridges affording reasonable navigational clearances based on transportation economics, and through modification of operating regulations on the existing movable-span bridges—are greater or less than the cost of modifying the fixed projections on the watercraft which require these extreme bridge features, or the cost of shifting the waterway traffic to types of watercraft that can be accommodated by such fixed bridges, or even the cost of relocating the waterway terminal to a point downstream from these bridges."

Because petroleum products are readily transportable by other means, even the feasibility of a pipeline from the existing terminal to an existing or potential waterway terminal below all these bridges should be explored. Any adjustment in waterway traffic that could be made to permit construction of a new fixed bridge with a vertical clearance based on the above considerations would have a tendency to reduce operation and maintenance costs on the other bridges for the accommodation of navigation. The Department of Commerce report suggests that bridge openings might be limited to a specific eight-hour period. This would eliminate the need for two of the three shifts of bridge tenders at present required on these structures.

A single watercraft which requires the opening of the new and old Highway Bridge across the Potomac River, creates a vehicular traffic jam that extends about three-fourths of a mile into Virginia and about eight-tenths of a mile into the District of Columbia. Conditions comparable to this problem on the Potomac River in Washington, D. C., can be found in many other urban areas on the banks of the nation's navigable waterways.

Floating construction equipment

In the State of Oregon, there are at least two movable-span bridges having adequate clearances in closed position for the accommodation of all normal river traffic, but the spans must be opened for the occasional movement of floating construction equipment. One of these bridges, constructed in 1951 about two miles from the mouth of the Coos River, actually cost $552,000. Of that cost, 25 percent, or $135,500, was expended solely for the accommodation of navigation. The annual pro rata of that investment, without interest, is about $1,685. The operation and maintenance costs on this bridge, solely for navigational needs, are $4,000 annually. The average cost of each of the 10 openings of this bridge for the accommodation of floating construction equipment during the base year is $568.50. In a similar situation on the Coquille River, the average cost of 20 bridge openings per year for floating equipment is about $275 each.

Opportunities for real public savings

Two recent decisions by the Corps of Engineers, made some time after the Commerce study was initiated, point out the real opportunities that exist for public savings on bridge costs without unduly hampering waterway traffic. One of them, involving a bridge across the Skagit River in Washington, resulted in a net public saving of $335,000. The added cost which would have been expended annually for operating and maintaining a movable-span bridge also was saved. In the case of this Skagit River bridge, the state initially applied for a permit to construct a vertical-lift bridge with a vertical clearance of 29 ft in closed position. It also requested federal aid in financing the structure.

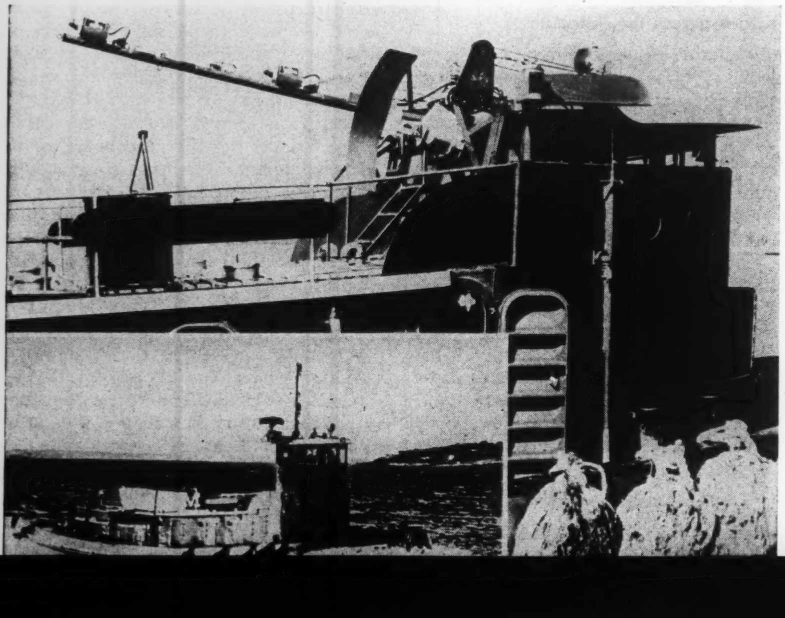
The facts indicated that an adjacent movable-span bridge had been opened only eight times in 1950, three times in 1951, twice in 1952, and four times in 1953. All openings, except two late in 1953, were for federally-owned craft operated by the Corps of Engineers to maintain the navigable channel upstream from the structure. The two exceptions involved the upstream and return trip of a pile driver, which reportedly could have had demountable leads.

Following negotiations and discussions between the Washington State Department of Highways, the Corps of Engineers, and the Bureau of Public Roads, the state filed a new application for a fixed bridge with a vertical clearance of 39.5 ft above normal river stage. The information indicated that the vertical-lift bridge would cost about $425,000 more than the fixed structure, and that continued expenditures for operating the vertical lift would also be involved. In arriving at its decision to approve the fixed structure, the Corps of Engineers pointed out that about $42,000 would be required to alter its vessels so they could pass under the new fixed bridge, and that the expense of disassembling equipment on the craft so that they could pass under the fixed bridge, and of reassembling it on the other side of the bridge, would be about $4,000 a year during the remaining 12 years' life of the equipment.

In the other case, immediate savings of $825,000 in bridge construction costs resulted from approval of a low-level fixed bridge across the North Branch of the Chicago River at Fullerton Avenue in Chicago, as compared with the cost of a movable span at the same location. The fixed bridge also eliminated the need for movable-span operating expenses and bridge tenders' salaries, estimated at $29,200 annually. Construction of replacement and new bridges across this fork as fixed structures, rather than a continuation of the former policy of building movable-span structures, is expected to result in a total long-range saving of $6,750,000. A substantial part of these savings will be realized within the next few years, when fixed bridges will replace the existing obsolete structure at North Western Avenue and West Diversey Avenue.

The foregoing examples and other data now available demonstrate that, under modern transportation conditions —where bridge costs are substantially increased solely to accommodate navigational needs—the traditional concept which considers navigation on the inland streams and intracoastal waterways as a form of low-cost transportation, is not always accurate. The validity of that concept is further questioned as a result of emerging plans for the construction of many new and replacement highway bridges across navigable waterways as part of an accelerated nationwide highway program. Any special provisions incorporated in these bridges solely for the accommodation of navigation most certainly will increase their cost. It is now realized that this added cost must be thought of in terms of cost per ton or ton-mile of waterway traffic, if it is to be significant in connection with navigational clearances. If the added cost is to be avoided, corrective measures are required.

Concerted action is needed by all affected transportation interests and by the general public in the remolding and shaping of existing policies governing this problem if a clear idea of the public interest is to be obtained. Navigational clearances for bridges should be based on transportation economics, except as the needs of federally-owned defense water craft and any special needs of craft engaged in foreign commerce are controlling. Where such exceptions are applicable, the Department of Commerce report recommends that the Federal Government assume the increased bridge costs resulting from such requirements.



Tug has retractable pilot house and hinged radar antenna—one solution to problem of limited bridge clearances.

What's wrong with engineering education

HERMAN L. DANFORTH, M. ASCE, City Engineer, Rockford, Ill.

Our engineering schools and colleges are doing a notable job of training technicians; they are not doing so well in educating engineers. This statement is sure to be challenged by many degree-bedecked authorities in the field of "engineering education." To disagree intelligently, it is best to avoid semantic pitfalls at the outset by defining terms.

Training is a process of imparting skill in the application of methods, procedures and techniques. Training may be quite simple—teaching Rover to roll over—or very complex. The distinguishing feature of training is that the process may require knowledge, but does not necessarily require the application of intelligence or creative thinking.

Education, on the other hand, is the development of ability to exercise intelligence and creative thinking. Through education we learn to question, not merely to accept.

A technician is adept at applying acquired techniques toward the accomplishment of a specified objective. Thus, a sufficiently skilled technician can "design" a bridge, provided he is given the span lengths, loading, material to be used, allowable unit stresses, type of construction, and other similar data. The "design" is accomplished by applying a series of techniques, starting, say, with drawing an influence diagram and ending with calculations for determining rivet spacing. The significant point is that the technician, to accomplish the specified objective, may require extensive training and practice but is not necessarily concerned with whether the assumed loadings are reasonable, whether the bridge is located most advantageously or is economically justified, whether prestressed concrete rather than steel might be superior both economically and esthetically, and many other possible considerations.

The above definition takes in many individuals who consider themselves—and are considered by others as—engineers. Where, then, shall we draw the line? Let us say that an individual is an engineer only to the degree to which he fits the following criteria:

1. He is possessed of adequate technical knowledge in his chosen branch to direct, coordinate, and evaluate the work of technicians.
2. He has the ability to think broadly—to relate problems to human values, to ultimate human wants and needs.
3. He has a basic understanding of the behavior of both materials and people under many varying situations. He is not content to accept and use standard formulas, loadings or allowable unit stresses without consideration of unique conditions. He is apt to consider unconventional solutions for unconventional problems.
4. He is able to convey to others his ideas clearly and concisely by drawings and sketches and through oral and written expression.

The validity of these proposed criteria is, of course, subject to question, but assuming that they are valid, how does the engineering graduate with a freshly engrossed sheepskin measure up? He has a good general understanding of the behavior of materials under various conditions; he also has some degree of mastery of the techniques in his chosen branch of engineering. In other respects he makes a poor showing. He can solve a design problem with considerable precision when all the conditions are laid out for him, but is frequently incapable of judging whether the solution is reasonable or whether the given conditions truly represent the facts as he may observe them. He is able to discern only dimly the relation between the work he is doing and the ultimate human values involved. The ability to approach problems broadly and creatively is quite lacking, as is facility in expressing such thoughts and ideas as he may have.

The other side of the picture is the problem facing the educators. Each advance in basic knowledge, methods, materials, and techniques—and the past half-century has produced torrents—increases the area a course of instruction must cover. Current literature in the field of engineering education reflects the dilemma—how to encompass the continually expanding area of engineering knowledge and at the same time give adequate attention to the humanities.

It would seem that these learned discussions miss certain basic considerations of fundamental importance to the engineering profession:

1. Is the approach to engineering studies valid? How much of the curriculum is based on custom and habit, and how much on an analysis of what a student needs to best fit him to practice his chosen profession?
2. To what extent can the subject matter of particular courses be modified to include thought-provoking situations which encourage and require broad thinking? And is it not true that misplaced emphasis on precision may inhibit thinking?
3. How can the student be taught to express himself concisely and fluently? Lecture courses and true-false exams simplify administration but add nothing to the student's ability to write and talk effectively.

It may well be that a good deal can be done within the present system to make up for some of the deficiencies. There seems also to be another way out of the educators' dilemma that has received scant consideration. Suppose two avenues were to be provided—down this path we train technicians, while over here we educate engineers. This is not to imply that the technician is in any sense a "lower" mortal than the engineer—just different, and fulfilling distinctly different needs.

Having set aside the problem of training technicians, we can cope more intelligently with the problem of educating engineers. If the validity of the previously suggested criteria is accepted, then the educational objective is clear.

Many of the problems facing the professional engineer—low pay, difficulty in securing recognition of professional status, common lack of knowledge and appreciation on the part of the public of the engineer's contribution to society—will tend to solve themselves when the graduate engineer emerges as a man of broadened interests and understanding and with the ability to express himself effectively.

Bedding and backfilling methods save reinforcing in

SAN DIEGO AQUEDUCT

ROBERT E. SAILER, M. ASCE, Engineer, U.S. Bureau of Reclamation, Denver, Colo.

To build the second barrel of the San Diego Aqueduct, the Bureau of Reclamation studied the effects of bedding and backfilling methods on the cost of the precast concrete pipe. Another problem was to avoid air entrainment at the entrance to long siphons, which on some other bureau projects has caused serious damage from blowbacks.

The pipeline has a capacity of 95 cfs. For 72 miles the water flows by gravity from an intake at El. 1500 (above sea level) to the San Vicente Reservoir at El. 760. Branching off from the Colorado River Aqueduct of the Metropolitan Water District at the outlet of the San Jacinto Tunnel, the San Diego Aqueduct runs southward, crossing several valleys in inverted siphons, passing in tunnels through mountain ridges, and ending at the San Vicente Reservoir of the City of San Diego. See Fig. 1.

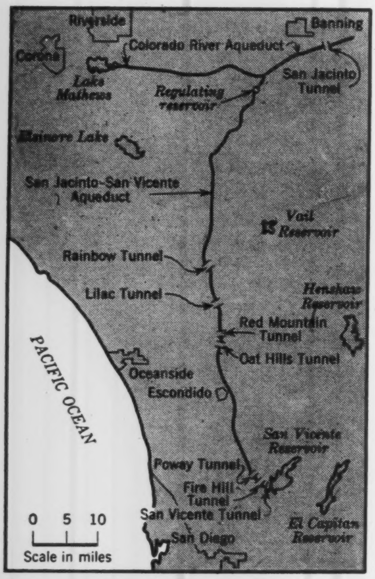

Riverside
Banning
Corona
Colorado River Aqueduct
San Jacinto Tunnel
Lake Mathews
Regulating reservoir
Elsinore Lake
San Jacinto-San Vicente Aqueduct
Vail Reservoir
Rainbow Tunnel
Lilac Tunnel
Henshaw Reservoir
Red Mountain Tunnel
Oat Hills Tunnel
PACIFIC OCEAN
Oceanside
Escondido
San Vicente Reservoir
Poway Tunnel
Fire Hill Tunnel
San Vicente Tunnel
San Diego
El Capitan Reservoir
0 5 10
Scale in miles

FIG. 1. San Diego Aqueduct extends from Colorado Aqueduct at San Jacinto Tunnel to San Vicente Reservoir of City of San Diego, crossing valleys in inverted siphons and mountain ridges in tunnels.

The second barrel of the aqueduct was completed in November 1954, and was designed and constructed by the Bureau of Reclamation for the U.S. Navy. The completed aqueduct was turned over to be operated by the Metropolitan Water District of Southern California and the San Diego County Water Authority. The latter agency will repay the U.S. Government according to a set schedule provided for in the authorization for the work.

The second pipeline, like the first, is constructed of precast concrete pipe. Non-cylinder type was used for hydrostatic heads up to 100 ft and cylinder type for heads above 100 ft. The maximum hydrostatic head on the concrete cylinder pipe is 650 ft. At the crossing of the San Luis Rey River, where the head is 900 ft, a steel pipe was installed.

To fit the hydraulic gradient to the topography, the pipe diameter was varied as necessary, using 75-, 60-, 54- and 48-in. sizes. As might be expected, the cost of the pipe represents a major part of the total cost of the aqueduct—about 80 per cent. Under these circumstances it was imperative to concentrate the major design effort on the pipe itself.

Concrete pipe of standard wall thickness is rigid and when buried must be designed to resist not only the internal water pressures but also the external earth loads. Over the years various assumptions as to the action of earth loads on pipe have been made. After careful study, the Bureau of Reclamation has adopted bulb-like earth pressures as the most logical of the various design assumptions, as shown in Fig. 2. The dotted line shows pressures measured in tests made on rigid pipe, taken from the Armco Handbook. The solid line shows the bulb-like pressures assumed in the design.

Pressures are assumed to act radially on the pipe and to vary with the central angle. The sum of the vertical components of the forces of the upper bulb equals the total vertical earth load. Similarly the lower or bearing bulb also equals the total earth load. Moments and shears that occur in the pipe on the above assumption can be calculated by a method developed by H. C. Olander and published in the Bureau of Reclamation Engineering Monograph No. 6 entitled "Stress Analysis of Concrete Pipe." Fortunately the final formulas for shears and moments are simple. Shears are equal to a coefficient times the total earth load; moments are equal to a coefficient times the radius of the pipe times the total earth loads.

The coefficients are independent of the pipe dimensions but vary with the width of the bearing pressure bulb. If the bearing narrows to a line, moments and shears are a maximum. They decrease as the width of the bearing is increased, and become a minimum when the bearing area extends over the entire lower half of the pipe. The advantages of this design method become immediately apparent when the effect of different widths of the bearing is to be evaluated.

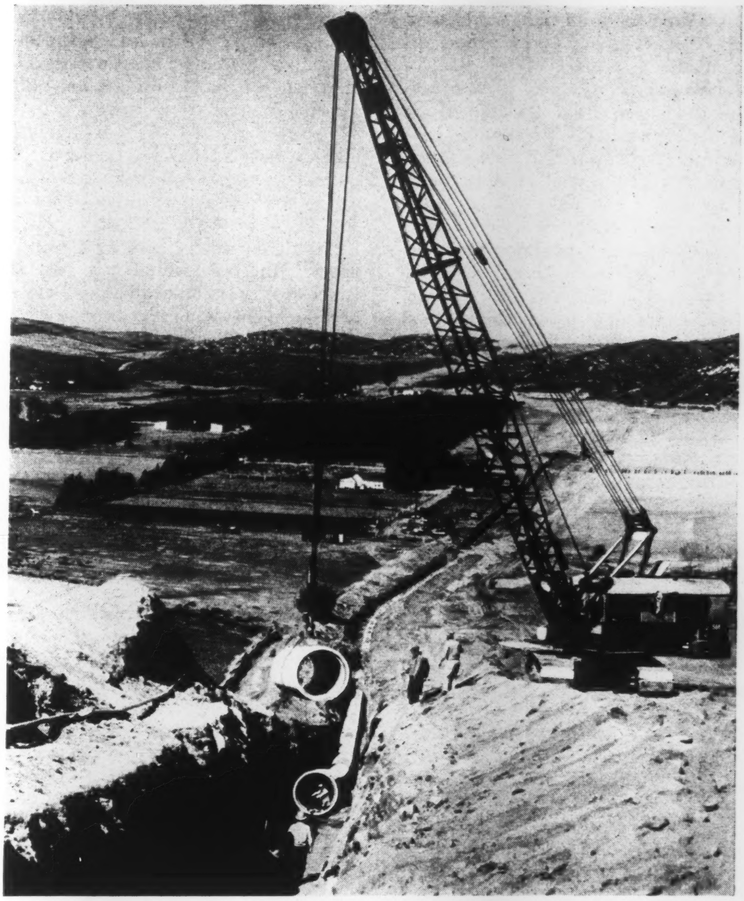
Moments caused by the earth loads greatly influence the amount of reinforcing steel required in the pipe. How the bending moments vary with various widths of the bearing is of interest. Assuming the maximum moment for a bedding over a 90-deg. central angle is 100 percent, we find that for a bedding over a 45-deg central angle, the moment is increased 25 percent. On the other hand, if the bedding is increased to, say, 120- or 180-deg central angles, the moments are decreased 14 percent and 31 percent respectively.

As the width of the bearing is increased or decreased, the quantities of bedding material also change. For instance, for a 60-in. concrete pipe, 26 percent less bedding material is required for a 45-deg arc of bearing than for a 90-deg arc. For the 120- and 180-deg bearing, 40 percent and 100 percent more material are required respectively, than for a 90-deg bearing.

Using this method, the designer can determine the amount of reinforcement for the various widths of bedding, and can balance the cost of the reinforcing steel in the pipe against the cost of the earthwork for the bedding. At the prevailing prices for the San Diego Aqueduct, it was found that bedding over a 90-deg central angle is most economical. The cost increases rapidly when the bedding is reduced to a 45-deg central angle, but increases little if the bedding extends over a 120-deg angle. As costs and conditions change with time, and also from one project to another, such studies should be made to obtain ultimate economy.

Two backfill methods

In the field, the top of the bedding is seldom defined accurately, and the very top layer of a densified backfill has a questionable bearing capacity. For these reasons the precautions illustrated in Fig. 3 (*a*) were taken. When the design is based on bedding over a 90-deg central angle, bedding over a 120-deg central angle is specified for construction. Similarly for the design assumption of a 120-deg central angle, the actual bedding is specified over a 180-deg angle.



Precast concrete pipe is being laid on a siphon in San Diego Aqueduct.

On the first barrel of the San Diego Aqueduct, a satisfactory bedding of the pipe could not always be obtained, particularly when some of the backfill materials were plastic clays. These materials, when mechanically compacted, formed lumps and did not give a uniform bearing. Where sandy materials were available, puddling, jetting, and vibrating methods were used. Some laboratory tests were also made with various methods of densification. Since the results were not altogether satisfactory, close attention was given to the various methods on subsequent projects. The resulting observations led to the adoption of two methods of bedding on the second pipeline.

The sketch, Fig. 3 (*a*) shows what is termed consolidated backfill bedding. The backfill bedding is compacted by a combination of jetting and vibrating. For this method of densification, it is essential to have free-draining material

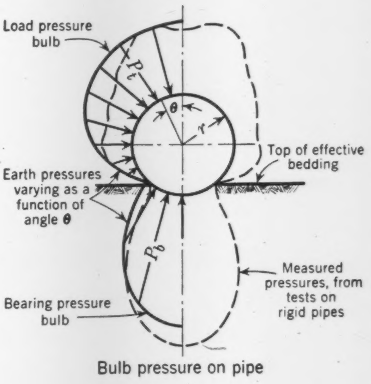


FIG. 2. Bulb-like pattern of earth pressures has been adopted by Bureau of Reclamation, after careful study, as most logical design assumption for action of earth loads on pipe.

such as sand, or sand and gravel mixtures containing not more than 15 percent of silty material passing a No. 200 screen. When jetting and vibrating methods were used, the trench was excavated with a flat bottom because experience has shown that this method assures that all the small spaces around the bottom of the pipe will be filled. The pipe trench was excavated to allow only a 9-in. working space on each side of the pipe, since vibrating and jetting were done from the top of the pipe. Experience has shown that this method is satisfactory for pipe laid on grades up to 30 per cent.

Where the slope exceeds 30 percent and where free-draining materials are not available, the second method of densification was used. This method, shown in Fig. 3 (*b*), is called compacted backfill bedding. In this case mechanical tamping was used since it is suitable for silty and clayey materials. In this method the bottom of the trench is shaped to fit the bottom of the pipe, to assure full cradle bearing. The cradle is shaped over a 55-deg central angle, which gives a 2:1 slope at the upper edge. An 18-in. working space was necessary on each side of the pipe to permit workmen to operate the mechanical tamper.

The first, or consolidated backfill bedding, is generally preferred as it seems to give more uniform and more satisfactory results. A cost comparison also favors the consolidated backfill, since with this method not only is the amount of excavation reduced but also the cost of consolidation is approximately half that of mechanical compaction. It was found economical to haul sandy material from borrow pits, as much as 10 miles away, without exceeding the cost of making compacted backfill. Hence, where the excavated material was not suitable for either method, sandy material was imported.

For the remainder of the trench backfill, no densification was generally required, an exception being road crossings where compaction was carried to the surface. The two methods of backfill bedding used on the second barrel of the San Diego Aqueduct gave very satisfactory results at a minimum of cost and have subsequently been used on other aqueducts of the Bureau.

Allowable pipe stresses

Now a few words about the unit stresses used in the stress analysis of the concrete cylinder pipe. For the first line built in 1947, the stresses used were those prevailing in the specifications, that is 12,000 psi for bursting and 20,000 psi when bursting is combined with external earth loads. Since that time the basis for these unit stresses has been reexamined. It was found that the unit stress of 12,000 psi was accepted when the cylinder was made of steel sheet material having a yield point of 25,000 psi. However, most West Coast suppliers of concrete cylinder pipe now furnish a grade of steel sheet material having a yield point of 33,000 psi. Taking advantage of this better grade of steel, the design unit stress of 12,000 psi was increased to 16,000 psi. This gives a safety factor of 2 to the yield point as in the first line. Since a little over half of the line was concrete cylinder pipe, a material saving resulted. Based on the bid prices, it is estimated that $300,000 was saved, or about 5 percent of the cost of the cylinder pipe.

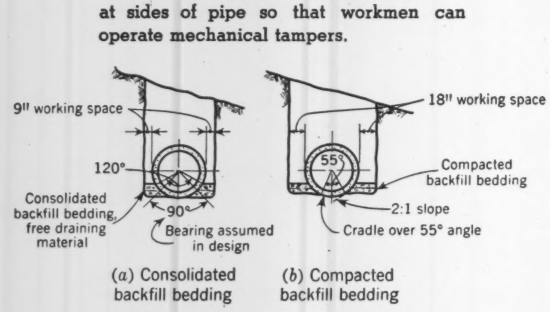
Blow-backs prevented

The San Diego Aqueduct crosses several broad valleys in long siphons. The longest siphon has a length of 12½ miles. On these long siphons a special problem arises from the hydraulic jump at the inlet leg. This problem can be illustrated best by reference to Fig. 4. The upper part shows a typical profile of a long siphon. The two main open-vent structures are to the left and to the right. The upper sloping line shows the design hydraulic gradient for full flow. The dotted line drawn horizontally through the invert of the lower vent structure is generally referred to as the pool level. Between these two lines the hydraulic gradient for partial flow is shown. This latter line intersects the inlet leg of the siphon.

The enlarged sketch in the lower part of the figure shows the flow conditions in the inlet leg. In the upper part of the inlet leg, the water will flow at high velocities and will fill the pipe only partially. A hydraulic jump occurs near the point of intersection of inlet leg and hydraulic gradient for partial flow. Below the jump the pipe is filled completely. It is this hydraulic jump that may cause trouble in long siphons. Air will be entrained and may accumulate into large bubbles downstream from the jump. These bubbles blow back with terrific force, taking water with them. These forces, on a siphon on the Belle Fourche Project in South Dakota, were sufficient to completely destroy the reinforced concrete platform on the inlet structure.

In siphons several miles long, the conditions described for partial flow may occur at the full design flow when the

FIG. 3. Two main types of backfill bedding have been used on San Diego and subsequent pipelines. For "consolidated" type, free-draining material is vibrated from top of pipe, requiring only narrow working space on each side. With "compacted" type, for use on slopes exceeding 30 percent and where free-draining material is not available, more space is left at sides of pipe so that workmen can operate mechanical tampers.


9" working space
120°
90°
Consolidated backfill bedding, free draining material
Bearing assumed in design
18" working space
55°
Compacted backfill bedding
2:1 slope
Cradle over 55° angle

(*a*) Consolidated backfill bedding

(*b*) Compacted backfill bedding

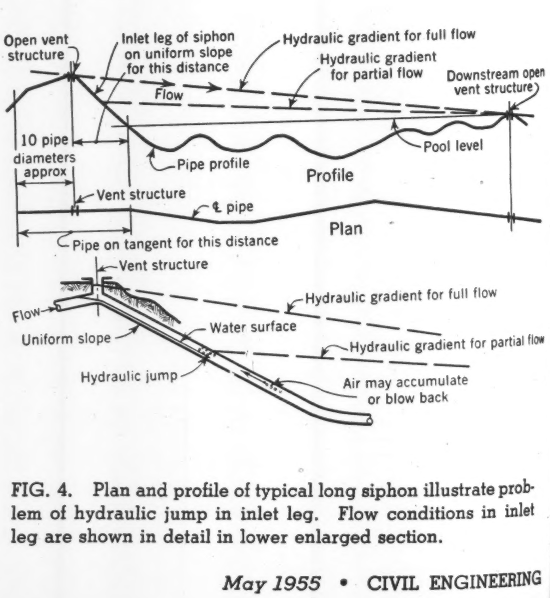

Open vent structure
Inlet leg of siphon on uniform slope for this distance
Hydraulic gradient for full flow
Hydraulic gradient for partial flow
Downstream open vent structure
Flow
10 pipe diameters approx
Pipe profile
Pool level
Profile
Vent structure
℄ pipe
Plan
Pipe on tangent for this distance
Vent structure
Flow
Hydraulic gradient for full flow
Water surface
Uniform slope
Hydraulic gradient for partial flow
Hydraulic jump
Air may accumulate or blow back

FIG. 4. Plan and profile of typical long siphon illustrate problem of hydraulic jump in inlet leg. Flow conditions in inlet leg are shown in detail in lower enlarged section.

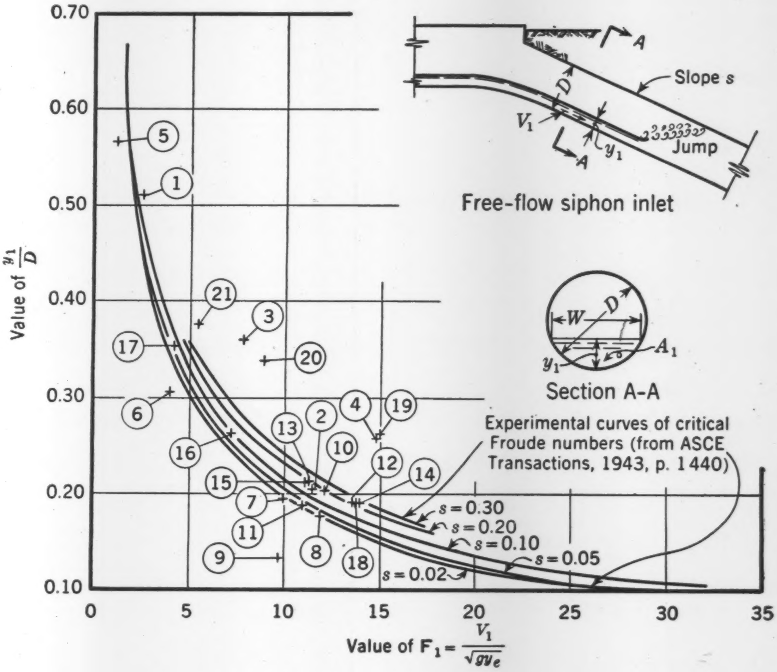


FIG. 5. On group of curves for various slopes of siphon inlet, Bureau of Reclamation spotted values for some existing siphons. It was found that inlets with values falling on or below the curves had given no trouble, but five inlets which fell above the curves had suffered from blowbacks.

actual friction coefficient is less than the friction coefficient assumed in the design. For this reason, the possibility of undesirable blowbacks should always be investigated for full design flow.

For a long time little was known about the conditions under which air will blow back and be destructive. The paper, "Entrainment of Air in Flowing Water: Closed Conduit Flow," by A. A. Kalinske and James M. Robertson (ASCE *Transactions*, Vol. 108, 1943, pp. 1435-1447) gives a group of curves for various slopes of pipe which separate two distinctly different actions as a result of the hydraulic jump. The group of curves is shown in Fig. 5. The curves for the various pipe slopes are drawn as functions of the ratio of water depth to pipe diameter Y_1/D and the Froude number, F_1. As the conclusions in the paper did not discuss practicable applications in detail, numerous existing siphons were analyzed by the Bureau according to the theory outlined in the paper. It was found that siphon inlets with values falling on or below the curves had given no trouble. However, siphon inlets that fell above the curves had given trouble with blowbacks. The latter are indicated by the heavy dark circles. Siphon inlets are now designed to fall on or below the curves, with the results that trouble has been avoided.

To simulate the basic conditions in the tests, certain requirements must be fulfilled, as shown in Fig. 4. The siphon inlets were placed on a straight alignment beginning at a distance of 10 pipe diameters upstream from the vent structure and ending at or beyond the intersection of the pipe with the pool level. Further, the vent structure was formed to give a smooth flow condition so as to avoid localized trapping of air. Finally the inlet leg was placed on a uniform grade, without any breaks from the vent structure to the pool level. When the above conditions have been fulfilled, blowbacks have been prevented by changing either the slope or the diameter of the pipe, or both, until the basic criteria given by the curves are met.

(This article was originally presented by Mr. Sailer as a paper at the ASCE San Diego Convention, before an Irrigation and Drainage Division session presided over by Harry F. Blaney, a member of the Division's Executive Committee.)

Notation:

Q = discharge, cfs
n = roughness coefficient
A_1 = water area for free flow, sq ft
V_1 = velocity for free flow, ft per sec
y_1 = water depth for free flow, ft
W = surface width for free flow, ft
r_1 = hydraulic radius for free flow, ft
D = diameter of pipe, ft
s = slope of pipe
F_1 = Froude numbers

Explanation:

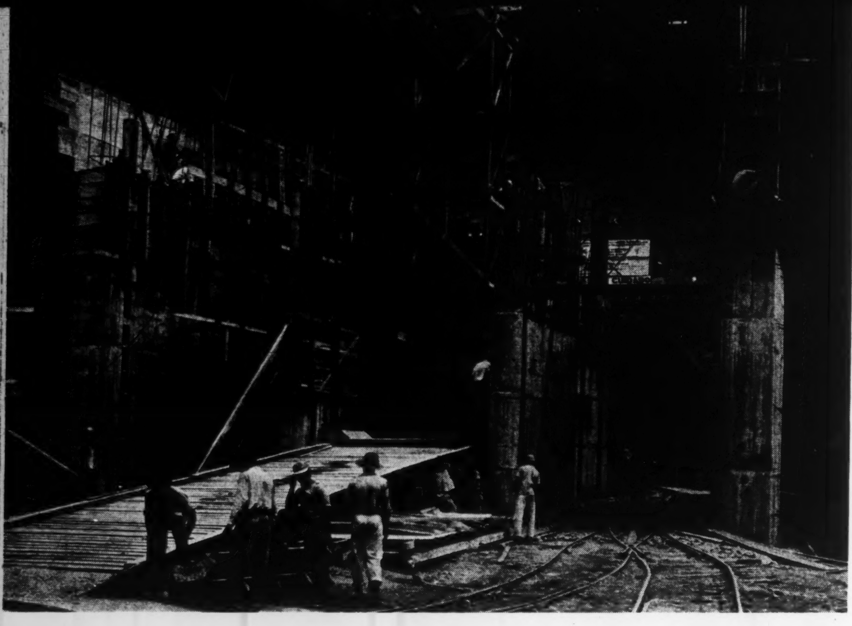
Siphon inlets marked with heavy circle have given trouble in operation, and air inlets were installed in some cases to relieve the blowing back of air and water. All other siphons have not given trouble in operation.

Study made indicates that free-flow siphon inlets designed so that Froude number will not fall above the critical curves established by experiments, will give satisfactory performance.

Procedure to determine Froude number for a given Q, diameter D, slope s, and coefficient n, is as follows:

1. Calculate V_1 from Chezy formula, $V_1 = c\sqrt{r_1 s}$
2. Calculate y_1
3. Calculate $W = 2\sqrt{(D - y_1)\, y_1}$
4. Calculate $y_e = A_1/W$
5. Calculate Froude number, $F_1 = \frac{V_1}{\sqrt{g y_e}}$

	LOCATION	TYPE OF PIPE	Q	D	n	s	$\frac{y_1}{D}$	F_1
1	Yakima River – Yakima Project	Conc.	925	111"	.010	.82	.511	2.47
2	Malheur River – Owyhee Project	Steel	325	80"	.010	.213	.205	11.60
③	Basin Siphon – King Hill	Wood	250	57"	.012	.17	.360	7.90
④	Basin Siphon – King Hill	Conc.	250	54"	.012	.61	.260	14.90
5	San Diego Sta. 620+00 N	Conc.	95	54"	.010	.0033	.567	1.25
6	San Diego Sta. 961+00 N	Conc.	95	54"	.010	.029	.305	4.10
7	San Diego Sta. 1146+00 N	Conc.	95	54"	.010	.19	.194	10.0
8	San Diego Sta. 1545+15 N	Conc.	95	54"	.010	.2716	.177	11.90
9	San Diego Sta. 1817+50 N	Conc.	95	72"	.010	.1935	.134	9.95
10	San Diego Sta. 1873+50 N	Conc.	95	48"	.010	.3053	.202	12.15
11	San Diego Sta. 2200+02 N	Conc.	95	54"	.010	.2198	.185	10.95
12	San Diego Sta. 1303+56 S	Conc.	95	48"	.010	.3643	.192	13.70
13	San Diego Sta. 1217+50 S	Conc.	95	48"	.010	.2563	.212	11.35
14	San Diego Sta. 1073+00 S	Conc.	95	48"	.010	.3714	.19	13.83
15	San Diego Sta. 1073+00 S	Conc.	95	48"	.012	.3714	.211	11.20
16	San Diego Sta. 419+00 S	Conc.	95	48"	.010	.104	.262	7.33
17	San Diego Sta. 171+96 S	Conc.	95	48"	.010	.0336	.355	4.17
18	San Diego Sta. 79+92 S	Conc.	95	48"	.010	.377	.190	13.80
⑲	High Mesa – Uncompaghre	Steel	42	26"	.010	.535	.264	15.00
⑳	Lake Valley Crossing P.G.E.	Steel	35	24"	.013	.367	.349	8.95
㉑	Lake Valley Crossing P.G.E.	Steel	25	24"	.016	.208	.378	5.43



HYDRO

Among hydro projects now under construction in Brazil is Santo Antonio (No. 10 in Fig. 1 and Table I) which will add 50,000 kw when completed in 1955. Intake tunnel for this project, entrance to which is seen above, is among largest in Brazil, has length of 14,436 ft and diameter of 21 ft 4 in. Diversion dam and intake structure for same project appear at right. Air view below shows another hydro project that is to be completed in 1955, Itutinga (No. 13 in Fig. 1 and Table I) which will add 36,000 kw in three initial units.

ADOLPH J. ACKERMAN, M. ASCE

Consulting Engineer, Madison, Wis.

—the answer to Brazil's power needs

In spite of great strides taken in recent years, Brazil is confronted with a nationwide shortage of electric energy, which in some areas has reached the status of a power crisis. Since Brazil's general electrification program is still in its infancy, the present is an important time for appraising basic problems and fundamental policies relating to power supply, and for proposing ways and means for future development which will best serve the country's interests. Of greatest importance at this stage is the adoption of long-range policies and technical standards under which the future electrification program can progress most effectively.

Significant facts listed

Some of the significant facts concerning Brazil's power supply are in brief:

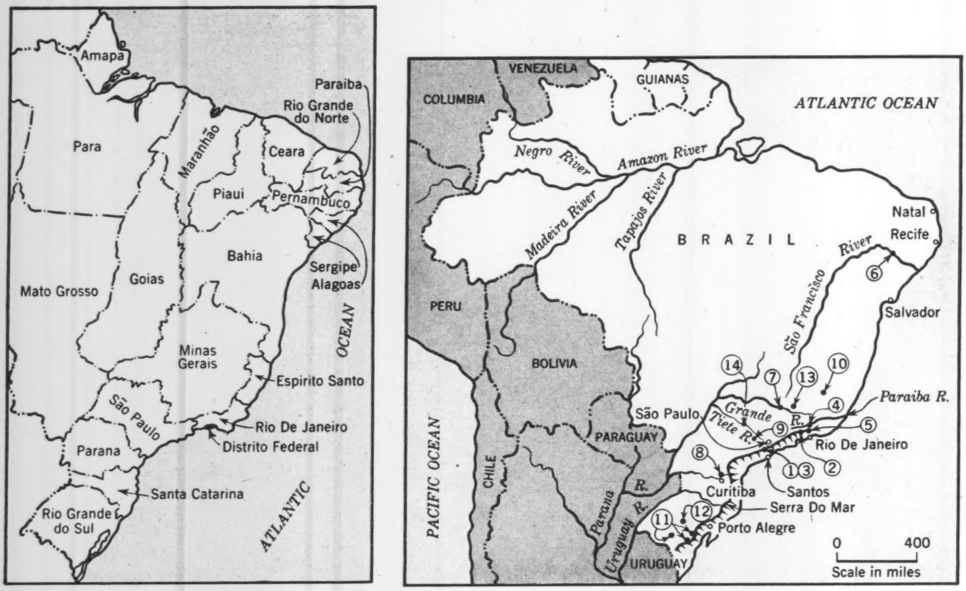
1. The burning of wood provides the greatest amount of Brazil's total energy in the form of heat for domestic use, small industrial processing, power generation, and railroad operation in the interior of the country.
2. Brazil's coal industry is in its infancy and there is no adequate supply for large-scale or widely dispersed development of steam power.
3. Potential petroleum resources have as yet not been developed. Fuel and diesel oil for power development must be imported, which adversely affects the balance of exchange.
4. The country is rich in hydroelectric potentialities, which have been estimated at 16,000,000 kw, based on dry-season flows, and at 30,000,000 kw with storage regulation.
5. The principal region of economic development is in the southern coastal states, extending from the State of Minas Gerais to Rio Grande do Sul, which represents about 17 percent of Brazil's total area. Of the country's total population of 52,000,000, 58 percent live in this region. Its cultivated area represents 73 percent of Brazil's total cultivated area. This region contains about 70 percent of the country's hydroelectric potentialities.
6. Brazil's installed generating capacity in 1952 was about 2,000,000 kw (about the same as the total in the State of Wisconsin) of which 70 percent is hydroelectric power.
7. The electric power supply comes from 2,000 power plants, of which over 1,700 have capacities of less than 1,000 kw each.
8. The total energy produced by public utilities in 1952 was 9,253,000,000 kwhr; of this, 75 percent was produced by two foreign-owned public utility systems.
9. Most of the power development has taken place in three states: São Paulo, Rio de Janeiro, and Minas Gerais. A few other states have capacities of more than 50,000 kw, but the installed capacity of most of the remaining states is substantially less than that amount.
10. Inflationary rises in costs, shortage of foreign exchange, high interest rates on locally available capital, and inadequate earnings, are preventing private concessionaire companies from meeting the rapidly growing demand for more energy.
11. Brazil has embarked on a nationwide program of public power development. Since World War II seven federal and state power authorities have been organized, and these obtain their principal finances from the State and Federal Treasuries.

Financing

12. Most of the generating, transmission and distribution equipment for public utility systems is imported—also, much of the consumer equipment. Annual production of electrical goods in Brazil was equivalent to U.S. $30,000,000 in 1950. Efforts are being made to increase the output of locally manufactured goods.
13. In 1951, the invested capital in public utility systems was in round numbers 10,000,000,000 cruzeiros, which is equivalent to between U.S. $500,000,000 and U.S. $750,000,000, depending on the value of the cruzeiro during past years.
14. Currently planned power developments and projects under construction since 1950 will provide 1,600,000 kw of additional capacity by the end of 1958. About one-third of this program has been completed to date.
15. Local funds will come chiefly from reinvestment of earnings and accumulated reserves, from sale of stock in local power companies to prospective consumers and other investors, and from electrification taxes which support the state and federal projects.
16. About one-third of the total capital required is for importation of electrical machinery and equipment, which is expected to be financed through loans granted by the World Bank, Export-Import Bank and similar sources.
17. Since 1948, foreign loans for electric development granted by the World Bank and the Export-Import Bank have totaled $207,000,000.

Technical features

18. Standardized transmission voltages and interconnected systems have not been developed. Standardization of frequencies is becoming increasingly important.
19. Because of lack of local fuel, Brazil must rely on future development of hydroelectric power. The North American practice of combining steam and hydroelectric power for most efficient system operation is not applicable to Brazil under present circumstances.
20. In an attempt to remedy the shortages of power in industry, a great number of diesel generating plants are being installed. It is estimated that since the end of World War II, about 200,000 kw of such equipment has been imported.
21. Small thermal plants and hydroelectric units are needed in many of the interior communities to help develop the


Amapa
Paraiba
Rio Grande do Norte
Para
Maranhão
Ceara
Piaui
Pernambuco
Bahia
Sergipe
Alagoas
Mato Grosso
Goias
Minas Gerais
OCEAN
Espirito Santo
São Paulo
Rio De Janeiro
Distrito Federal
Parana
Santa Catarina
ATLANTIC
Rio Grande do Sul
VENEZUELA
GUIANAS
COLUMBIA
ATLANTIC OCEAN
Negro River
Amazon River
Madeira River
Tapajos River
B R A Z I L
Natal
Recife
São Francisco River
PERU
Salvador
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⑭
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⑤
São Paulo
Grande R.
Tiete R.
⑨
PARAGUAY
Rio De Janeiro
⑧
①③
②
PACIFIC OCEAN
CHILE
Parana R.
Uruguay R.
Curitiba
Santos
Serra Do Mar
⑪
⑫
Porto Alegre
URUGUAY
0
400
Scale in miles
⑥

FIG. 1. Maps of Brazil give states into which country is divided (far left) and location of main hydroelectric projects by number (left). For key to numbered projects see Table I (at right).

country agriculturally to a point where Brazil can eventually feed herself, and to reverse the present population drift toward the larger cities.

22. The shortage of engineers and technical personnel in Brazil is even more serious than the present shortage of electrical energy.

Present power supply reviewed

Brazil's principal hydroelectric power developments are listed in Table I and their location is shown on the map, Fig. 1. In Fig. 2 the development of hydro and thermal power (mostly wood-burning) from 1883 to 1952 is indicated graphically. A discussion of the power situation in various parts of the country follows.

Over the years the Federal District and the central and western part of the State of Rio de Janeiro have had an abundant supply of electric energy, and a good supply of power is in prospect until about 1960.

The northern and western parts of the state are being served by the Rio de Janeiro Tramway, Light and Power Company, a subsidiary of the Brazilian Traction, Light and Power Company of Toronto, Canada. This is largely a hydroelectric system operating at 50 cycles. It had an available generating capacity, before November 1953, of 381,000 kw, the principal power plants being the Fontes plant at Lajes with a capacity of 154,000 kw, and the Ilha dos Pombos plant with a capacity of 140,000 kw. In November 1953, the first unit of the new Forçacava underground power development (since then renamed Nilo Pecanha) was placed in service. This plant has a capacity of 330,000 kw, and at the time it went into service was the first large underground power station in the western hemisphere. A more detailed description of this project and its water supply facilities, the Paraiba Pirai Diversion Project, was published in CIVIL ENGINEERING for November 1951. Provisions have been made for ultimately adding a further 360,000 kw at this site.

The power company's Lajes Reservoir also serves as the principal reservoir for the domestic water supply for the city of Rio de Janeiro.

Across the bay from Rio de Janeiro, the territory is served by Cia. Brasileira de Energia Eletrica, a subsidiary of the American and Foreign Power Company. This company, until recently, had a generating capacity of 34,000 kw and operates at 60 cycles. A new steam plant with an initial installation of 10,000 kw went into operation in 1954. Because of the limited area in which the company operates, it has small opportunity to develop additional sources of hydroelectric power.

The largest power system in Brazil is that of the São Paulo Light and Power Company, Ltd., a subsidiary of Brazilian Traction Light and Power Company of Toronto, Canada. This system has a capacity of 600,000 kw and operates at 60 cycles; the most important power plant is the high-head development at Cubatão with a capacity of 474,000 kw. The abundant supply of hydroelectric power has been the primary factor in the tremendous growth of the City of São Paulo and its great industrial expansion. This power supply and the Rio de Janeiro system were chiefly developed and planned by the late A. W. K. Billings (Hon. M. ASCE) whose remarkable career has been recorded in *Billings and Water Power in Brazil*, which was published by ASCE in 1953.

During the past several years the company has not been able to meet the new demand and a very serious power shortage currently exists in its territory. A new underground hydroelectric plant at Cubatão with an ultimate capacity of 390,000 kw was started in 1951 and is scheduled for initial operation in 1956 with the first of four 65,000-kw units. In 1952 the company also started construction of the Piratininga Steam Plant containing two 80,000-kw generating units, the first of which went into operation late in 1954.

The American and Foreign Power Company, through its wholly-owned subsidiary, has a controlling interest in 15 operating companies and a management company in Brazil. These companies are located in various cities along the eastern coast from Natal in the north to Porto Alegre in the extreme south. The combined generating capacity of its power plants is 251,000 kw.

Annual growth in demand is currently at the rate of 10 to 12 percent per year in most of the service territories.

The most important subsidiary, Cia.

TABLE I. Principal hydroelectric developments in Brazil

Name of Project	Capacity, kw	River	State	Owner	Date of Completion
1. Cubatão	474,000	Rio Grande	São Paulo	Brazilian Traction Light & Power Co.	1927, 1951
2. Nilo Pecanha (Forçacava)	330,000	Paraiba	Rio de Janeiro	Same	1954
3. Cubatão Underground (First Step)	260,000	Rio Grande	São Paulo	Same	1956
4. Ilha dos Pombos	162,000	Paraiba	Rio de Janeiro	Same	1924, 1947
5. Fontes	154,000	Lajes	Rio de Janeiro	Same	1908, 1946
6. Paulo Afonso	120,000	São Francisco	Bahia	Federal Government	1955
7. Peixoto	80,000	Rio Grande	São Paulo	Am. & For. Power Co.	1958
8. Salto Grande	60,000	Paranapanema	São Paulo	State of São Paulo	1956
9. Itupararanga	57,500	Sorocaba	São Paulo	Brazilian Traction	1925
10. Santo Antonio	50,000	Rio Doce	Minas Gerais	State of Minas Gerais	1955
11. Jacuí	46,600	Jacuí	Rio Grande do Sul	State of Rio Grande do Sul	1958
12. Canastra	42,000	Santa Maria	Same	Same	1957
13. Itutinga	36,000	Alto Rio Grande	Minas Gerais	State of Minas Gerais	1955
14. Avanhandava	30,000	Tieté	São Paulo	Am. & For. Power Co.	1950

Paulista de Forca e Luz in the State of São Paulo, has a total generating capacity of 90,700 kw. In addition to several new smaller plants, this company has embarked on an expansion program involving the construction of a large dam on the Rio Grande in the northern part of the state. Initially, 80,000 kw will be installed, but the site can be developed to a maximum of 400,000 kw. This will contribute substantially to the development of the interior of the state.

The local subsidiary in the State of Rio de Janeiro is also expanding its system, as previously mentioned, by adding a 10,000-kw steam plant to its present system capacity of 34,000 kw.

In the service territories of the States of Minas Gerais, Pernambuco, Bahia, and Rio Grande do Sul, the supply of new power is being taken over by federal and state power developments. This is leading to discontinuation of further expansion plans by the local subsidiaries, except in their distribution systems. The subsidiaries plan to buy power from these publicly-owned projects and distribute it to the consumers.

The State of Parana is rapidly growing in importance but at present has only 55,000 kw of installed generating capacity, made up of 75 separate systems. Parana has over 4,000,000 kw of hydroelectric potential, and various plans are currently under consideration for organizing a long-range program of development.

One of the subsidiaries of American and Foreign Power Company is serving the capital city of Curitiba and surrounding communities. Its present generating capacity of 22,000 kw, in the Chamine hydro station, is being expanded by the construction of the Guaricana hydroelectric plant with a capacity of 20,000 kw. However, the state is also attempting to deal with the problem of developing a general electrification program.

In summary, the American and Foreign Power Company has a program of expansion for the period of 1952 to 1956 which will add a total of 176,500 kw of new generating capacity to the various subsidiary systems.

In 1950 the State of São Paulo embarked on a hydroelectric program of its own. The first step is the Salto Grande Project on the Paranapanema River in the western part of the state. Construction of this project was started by the state-owned Sorocabana Railroad, primarily to provide power for its railroad electrification. The project has been designed for an ultimate capacity of 60,000 kw and is scheduled for completion by the end of 1956.

In the State of Minas Gerais, private utilities have not been able to provide the energy needed by the various industries and municipalities because of inflation, inadequate power rates, and low returns on investments. The state government has, in consequence, embarked on a comprehensive program of electrification.

In 1950 the state had 439 power plants, large and small, with an aggregate capacity of 218,000 kw. Many of these plants serve private industries such as mines, factories, and mills. The 439 plants have 359 different owners. Only four plants have capacities in excess of 5,000 kw.

Cia. Forca e Luz de Minas Gerais (subsidiary of American and Foreign Power Company) serves the city of Belo Horizonte and nearby communities with a generating capacity of 24,724 kw and 9,000 kw of purchased power for the state-owned power system.

From 1949 to 1951 the state adopted various laws to formalize its future program of electrification under state sponsorship. The principal holding company representing the state's interest is known as CEMIG (Centrais Electricas de Minas Gerais, S.A.).

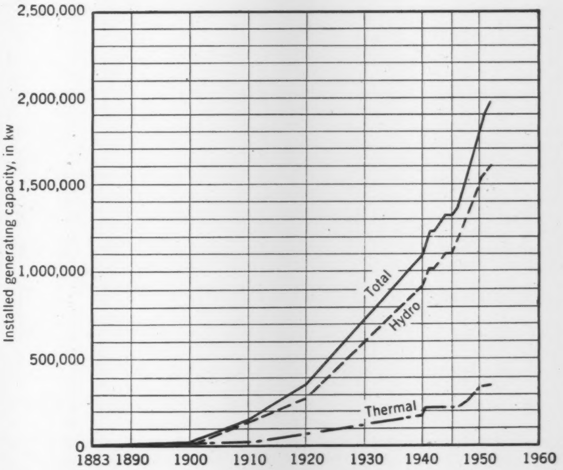
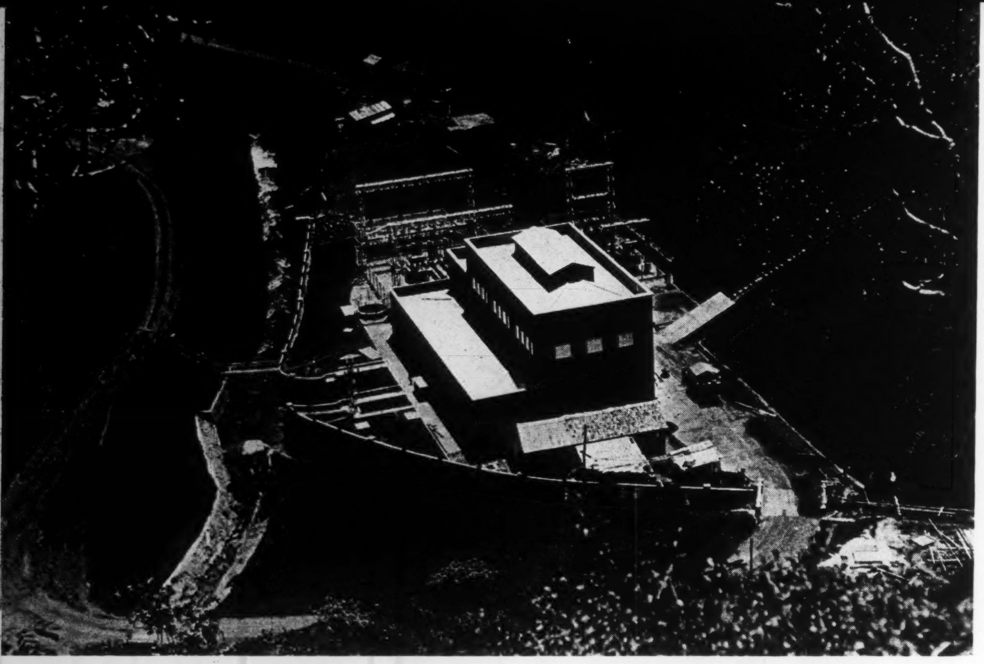


FIG. 2. Hydroelectric development in Brazil has shot forward since World War II.



Good example of a small hydroelectric project in Brazil is Bugres Plant in State of Rio Grande do Sul, completed in 1952. Capacity is 10,800 kw and head utilized is 550 ft.

This company is designed to establish, manage, finance, provide technical, accounting, legal, and executive assistance to its subsidiaries which are "mixed" companies of regional character, whose purpose is to develop the electric power and related transmission and distribution systems in their respective zones of influence.

At present the state owns three small hydro developments, and has under construction the Itutinga Project (36,000 kw) and Santo Antonio (50,000 kw initial). Future plans are being developed in an orderly manner and sound technical standards are being adopted. The continuing expansion program depends chiefly on overcoming the currently difficult problems of financing.

The State of Santa Catarina is the principal source of Brazil's coal; it has a relatively small generating capacity—45,000 kw, including a mine-mouth steam plant with a capacity of 18,000 kw. The quality of the coal is relatively poor; only 27 percent of the mined product at present is recoverable in a form suitable for commercial disposal. This accounts for the high cost of local coal, which is greater than that of imported coal. Relatively little is known about the geology and available coal reserves. Future plans for electrification could to advantage be integrated with the programs of the adjacent states of Rio Grande do Sul and Parana.

In Rio Grande do Sul the total generating capacity for public utility service was 80,000 kw in 1952. In addition, there was a total of about 100,000 kw of generating capacity installed in numerous factories, mostly in the interior of the state. The principal private utility (a subsidiary of American and Foreign Power Company) serves the capital of Porto Alegre with a steam plant rated at 24,600-kw capacity.

The State Electrification Commission of Rio Grande do Sul was organized immediately after World War II and is undertaking a comprehensive program of electrification. As a first step emergency diesel generating plants were installed in various parts of the state, particularly in the rural areas, along with small hydroelectric projects. As a second step larger projects were, and are now, under construction; a further program has been planned for future development as still larger projects become economically justified.

In the first stage, a total of 62,000 kw were installed. The second stage will involve the installation of 286,000 kw of new capacity. An important development is the 20,000-kw mine-mouth steam plant, São Jeronimo, which is capable of burning coal with an ash content of 45 percent. This is the largest steam plant in Brazil burning local coal. The entire program is being financed through an electrification tax, and the foreign imports are financed by a loan of U.S. $25,000,000 from the International Bank for Reconstruction and Development.

Paulo Afonso, a major federal project

The Paulo Afonso Project is being constructed by the Federal Government, which is providing all the local funds. The imported equipment, materials and supplies are being financed by a loan from the International Bank in the amount of $15,000,000. The project is in a remote location, which has added materially to the construction difficulties and has raised controversial issues. However, the project has had the benefit of honest administration, and a conscientious effort has been devoted to the engineering and construction work.

This project was inaugurated late in 1954 with an initial capacity of 120,000 kw; it will deliver power over two transmission lines about 400 km long to the cities of Salvador to the south and Recife to the east. The local power companies (subsidiaries of American and Foreign Power Company) which are located in these two cities are expected to buy 80 percent of the total initial output.

This is one of Brazil's major hydroelectric developments. As the demand for power is increased, the project can in future years be enlarged to 540,000 kw. Furthermore, with adequate upstream storage, it is claimed that further enlargement will be possible.

What of the future?

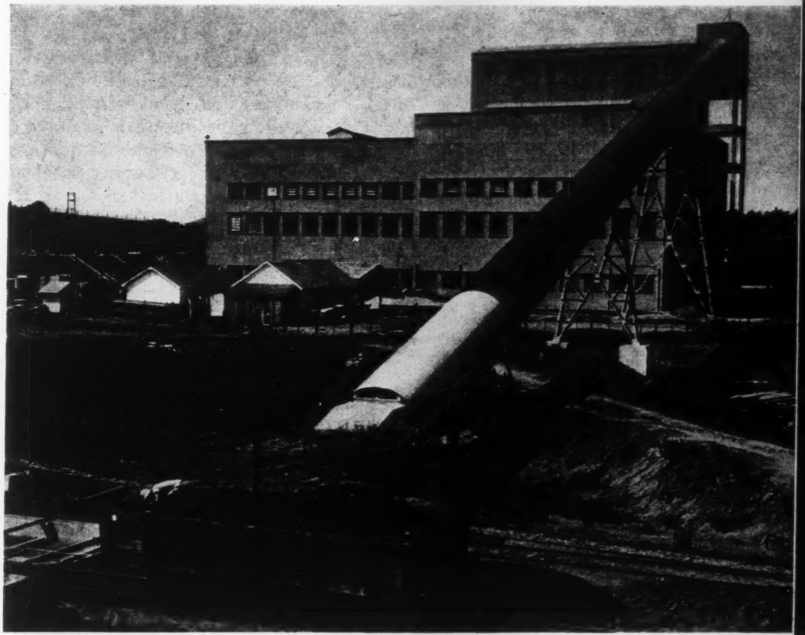
In summary, it should be emphasized that Brazil is blessed with great resources of hydroelectric power, and the development of these resources is fundamental to the country's future economic growth and industrialization. In Brazil the position of thermal power in the overall economic development is unique. Small power plants which burn locally available wood may be found in all parts of the country. Diesel power plants are especially useful in interior agricultural regions where water power is not readily available. Steam plants may in exceptional cases be justified as protection against periodic droughts and to carry peak loads of limited duration.

However, as long as Brazil's oil and coal resources remain undeveloped, and as long as foreign exchange is needed for the importation of essentials other than such fuels, Brazil is confronted with the necessity of developing its hydroelectric resources to the fullest extent possible. A simple formula to keep in mind is the following: The annual payments for imported fuel oil consumed in a steam plant (operating at a high load factor) would be equal to the annual charges on a loan to finance the importation of all equipment for a hydroelectric development whose generating capacity would be 6 to 8 times greater than the capacity of the steam plant.

The construction of a thermal peaking plant can only be undertaken if a suitable adjustment in the rate structure is made to compensate for the increased cost of operating such special generating facilities for very limited periods of time. The choice of method in adjusting the charges to consumers plays a vital part, thereafter, in determining the course of progressive development of a power system along the best and most economical lines. Depending on the formula used for rate ajustments, an incentive might develop to favor the development of thermal generating capacity, operating at high annual capacity factors and, conversely, to encourage the conservation of the hydraulic resources, in spite of the fact that they may be abundantly available. This would be the case, for example, where 100 percent of the cost of the fuel consumed in a thermal plant is added as a surcharge to the established rates for a hydroelectric system. Where the importation of fuel demands the diversion of precious foreign exchange, which is already in short supply, the financial position of a country could by this means become very adversely affected over a period of years.

The protection of the national interest in such matters calls for far-sighted planning on the part of all who have a share in this responsibility. For a hydroelectric project, the hydrology, land acquisition and governmental concessions generally require the preliminary work to begin two to three years earlier than is needed for a thermal plant. Where such preliminaries have been neglected, the resulting power shortage may create a public clamor for the quickest possible solution, and for this a thermal plant presents a tempting answer, since its harmful effect on the country's credit position may then be claimed, in some quarters, to be a less serious prospect than the consequences of a local power shortage. The heart of the problem, therefore, lies in the wisdom and perseverance which is exercised in the preliminary planning stage of a hydroelectric project.

(This article is part of a paper and discussion presented by Mr. Ackerman at the Sectional Meeting of the World Power Conference in Rio de Janeiro in August 1954, and is based upon six years of residence and professional service in Brazil.)



Above: Locally mined coal of poor quality (ash content, 45 percent) is burned in São Jeronimo Steam Plant, which provides 20,000 kw in State of Rio Grande do Sul, near Porto Alegre.

Right:

Hydroelectric project of largest capacity in Brazil is Cubatão, near São Paulo (No. 1 in Table I), which provides 474,000 kw at a 2,100-ft head.

UNIONS, UNITY OR UTOPIA

HUGH MULHOLLAND, J. M. ASCE

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The following four articles, generated by the Salary Committee of the Los Angeles Section's Junior Forum, were presented in a panel discussion sponsored by ASCE's Committee on Junior Members and given before the Conditions of Practice session at the San Diego Convention. William J. Carroll is Chairman of the Forum Committee; Finley B. Laverty is Vice Chairman of the Committe on Junior Members; and Mason G. Lockwood, Vice President, presided over the session. Constructive comments by Junior Members and others should be addressed to Mr. Laverty at 502 Lakewood Road, Pasadena 2, Calif.

Over a year ago, the economic problem, which is all too obvious to most of us, became a topic of discussion among a group of Junior Forum members in the Los Angeles Section. The culmination of this discussion was the formation of a seven-man Salary Committee, representing a cross-section of the Junior civil engineering field. Of the seven committee members, two were formerly in public works and are at present with a consulting engineer; the third was an engineer-superintendent for a contractor and now has a contracting firm of his own; the fourth is the assistant city engineer of a growing municipality, and formerly was with a consulting firm; the fifth is sales manager for a steel company and formerly worked for a consulting firm; the sixth is a coordinating design engineer for a structural engineering firm; and the seventh is a sales engineer for a national steel company and formerly worked in a structural engineer's office.

This seven-man group set itself up primarily to look into three basic questions:

1. What is the true relative income of the civil engineer?
2. What has been done to improve the engineer's income, whether high or low?
3. What further measures should be taken to better the engineer's economic, professional, and technical status?

We think we have resolved the first two questions. The engineer's income is relatively low as compared with that of the construction worker or the medical man. The basis for this statement was presented in a paper prepared by this committee, presented by William Carroll, J. M. ASCE, at the New York Convention of the Society and published in the November 1954 issue of CIVIL ENGINEERING. Also we found that much has been published on these problems and some action has been taken to correct objectionable conditions.

Here the third and most critical question presents itself. What avenues can we as engineers take in an effort to alleviate the inequities of our economic position? As soon as we start to examine the economic problem, two other questions arise: (1) what effect will action by ASCE or others in any given direction have upon the engineer's professional status; and (2) how will such action affect the engineer's technical advancement?

How then are we going to tackle our problem? Are unions the answer? What have unions to offer the professional man? Why are unions interested in the professional engineer? And what objections are there to unionization? Hal Halldin will present some of the prevailing views on these questions.

On a second tack, what does the present unity program offer? What is the unity organization? What do we ask of the unity organization? What role can it play toward answering our problems? Bill Keener will present unity as an answer to the engineer's problems.

Finally, can we have a utopia? Can we pay small dues, have a strong aggressive organization, improve our professional status, expect to increase our technical knowledge through publications—all by free aggressive individualism? Above all else, can we do these things and have an income commensurate with our education, responsibility, and real value to the community in which we live? Hodge Gaines will talk this over with you.

Unions

HAROLD A. HALLDIN, J. M. ASCE

Assistant City Engineer, Alhambra, Calif.

Unionization and collective bargaining have been considered as possible solutions to our economic and professional problems. First, let's define the terms—unions, collective bargaining, and professional employee.

A labor union is the name applied to an organization of employees which is one party to a desired labor contract. The other party to the contract is the employer or group of employers.

Collective bargaining in its ideal form is a process of discussion between representatives of organized employees and their employers, in an attempt to agree on the terms under which the employees will work for their employers.

Professional employee means any employee engaged in work predominantly intellectual and varied in character, involving the consistent exercise of discretion and judgment in its performance, of such a character that the output produced or the result accomplished cannot be standardized in relation to a given period of time and requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction. This definition is condensed from Section 2 (12) of the Taft-Hartley Act.

Assuming acceptance of these definitions for the time being, I will review some of the arguments for and against collective bargaining for professional employees—the type of collective bargaining sponsored by ASCE in 1943 to protect professional employees from being forced into the trade-union type of collective bargaining.

Argument No. 1

Opponents of collective bargaining say a union of, and a strike by, professional employees is not ethical and that a strike is a conspiracy.

Proponents say that it is a natural right of mankind to unionize and bargain collectively and that collective bargaining by its very nature includes the right to strike. It is a logical assumption that if employees cannot agree with their employer as to the terms upon which they will work, they will not work. They can strike collectively and effectively if they are organized. If individual employees are not reasonably satisfied with working conditions, their initiative and efficiency is bound to drop, so either way, organized or unorganized, there is some form of strike if employees are not working for their employer under conditions which the employees consider fair.

Argument No. 2

Opponents say local unions eventually band together to form a national union. Then the employer no longer deals with the desires of his own employees, but with the directives of a national union. Also this national union in time will be controlled by subprofessionals.

Proponents say that none of these drawbacks need occur. They state that if employment conditions were entirely satisfactory, collective bargaining would not be necessary. By the same reasoning, if collective bargaining were successful at the local level, a national organization would not be necessary. In answer to the thought that subprofessionals will in time gain control, it should be noted here that in the 1953 ASCE Questionnaire on Employment Conditions, 95 percent of those who believed collective bargaining to be advantageous preferred a union controlled by professionals. It appears then that control by professionals can be maintained.

Argument No. 3

Opponents argue that belonging to a union reduces the chances of advancement to supervisory and managerial positions.

Proponents state that management must draw from the ranks of employees to fill such positions. These men are familiar with the work and also would know the views of organized employees. They point to several highly placed professional engineers in the Los Angeles area who have been or are at present members of a collective bargaining agency.

Argument No. 4

Opponents say the professional employee should bargain with his employer as an individual on the basis of his ability and not use the crutch of a union organization to aid him.

Proponents say this is what has been done in the past, and apparently without success, as there are many engineers who still feel they are not receiving sufficient remuneration for their ability. They say that in many cases the individual is either heard from through his representative or he is not heard from at all.

Argument No. 5

Opponents say joining a union develops a feeling of animosity between employees and management and its supervisors. Employee relations will be destroyed.

Proponents say that animosity can develop with or without unions. More often than not, with unionization, employee-employer relations are improved, especially if employees and employers are realistic. With the improvement of employee relations, efficiency and productivity also will improve.

Argument No. 6

Opponents say that engineer employees who bargain collectively will lose their professional status, will reduce their profession to a trade, will standardize their output, and will limit the amount of work they do. Unionization will kill the rugged individualism of which this country, and especially its engineers are so proud.

I should state here that in arguments for and against unionization of engineers, it is the use of the term, "professional status," and the arguments surrounding it that do more to upset a union movement than any of the other arguments. What is professional status? Is it something resulting from the individual's accomplishments in the field of engineering, or from his possession of a license to practice engineering? Is it the status he has in the minds of his employers, subprofessional associates, fellow workers, friends or neighbors as a result of his being an engineer? Is it due to the fact that he carries out his work without regard to the size of his paycheck or the clock?

Proponents say unions will increase professional status, whatever it is. Their reason—more money, which could be spent for advanced education, a home among those of doctors, dentists and lawyers, or for such things as the repainting of his house by a painter instead of by himself, so that more of his time could be devoted to community, church, and political activities.

We do have a problem—a difficult one—that of raising the economic and professional position of the engineer. Can unions do it? The arguments that have been given both for and against unionization of professionals indicate the possibility that unionization in certain cases, in certain situations, may be a necessity, and that a union organization, if run by professional people in a professional manner, could be successful. Such organizations would not eliminate the existing Founder Societies, which have as one of their basic functions the technical advancement of the engineer. In fact, unionization will enhance the technical position of the engineer because, as stated earlier, there would be more money to join technical societies and to pursue advanced education.

In conclusion, and from the arguments just presented, it appears that raising the economic position of engineers will raise their professional status and provide opportunity for more technical advancement. There is no single and easy solution to the problem of raising the economic position of the engineer employee. In effect the opponents of collective bargaining say the professional way to get a raise is to ask for one on the basis of your energy, ability, and productivity. If this is true and you are an employee who is eager, able, and productive, you should study, review, and present to your employer the reasons why your income should be increased. It is as simple as that. But is it? Will your reasons stand up against the arguments of your employer? To strengthen your reasons you might consult with your fellow employees. Their ideas and arguments could make your individual case stronger. To carry this a little further, the proponents say, **"Imagine what the effect would be if you and your fellow workers organized and presented these collectively-thought-out ideas to your employer!" This is that collective bargaining which may be today's solution to the problem of increasing your economic, professional, and technical status.**

UNIONS, UNITY OR UTOPIA

Unity

WILLIAM J. KEENER, J. M. ASCE

Sales Manager, Norris Steel Company, Los Angeles, Calif.

What is unity? It is a singleness of purpose or action, a harmonious adjustment of constituent elements. It is something every family must have to exist. The family of engineers is no exception!

We all understand the necessity for unity in our basic family life and the difficulties we sometimes have in reaching a harmonious adjustment between two or three people. Fortunately, the difficulties are not directly proportional to the number of people in the family. In fact, it seems that there is more unity in larger families.

But what does this have to do with the subject before us—the role of a unity organization in solving the civil engineer's economic and professional problems, in furthering his technical advancement? By definition engineers compose a large family, a technical tribe having within its ranks men skilled in various lines, but all with a single purpose—that of making our world a better place to live in by providing facilities which make life easier. It is logical then that this family of engineers should join together to be efficient.

A single family of engineers can and has helped the individual engineer professionally and technically at both national and local levels. In fact, it has many advantages over individual representation. Unification of engineers should help the individual engineer's economic position, regardless of whether he is employer or employee.

Definite steps have been taken toward forming a unified family of all professional engineers similar to organizations in the other professions. The organization known as Engineers Joint Council (EJC) is now acting as head of the engineering family. The men on this council are members of the governing boards or officers of the member societies consisting of the ASCE, AIChE (American Institute of Chemical Engineers), AIEE (American Institute of Electrical Engineers), AIME (American Institue of Mining and Metallurgical Engineers), ASME (American Society of Mechanical Engineers), ASEE (American Society for Engineering Education), AWWA (American Water Works Association), and SNAME (Society of Naval Architects and Marine Engineers). The majority of the members of these societies are either graduates of engineering colleges or are registered by a state board of registration for professional engineers. This council represents a family of engineers numbering more than 170,000.

A review of the history of engineering unity organizations would take us back to 1917 when the Engineering Council of the National Technical Societies of America was established. Its major function at that time was to assist in development of machinery for national defense. In 1920, at the request of the then Secretary of Commerce, Herbert Hoover, Hon. M. ASCE, American Engineering Council (AEC) was formed to cope with the rapid industrial growth of the country. This organization took over the wartime studies of the earlier Council but did not maintain strong relationships with the fostering societies. Because of this shortcoming, AEC faded from the unity picture in 1940. World War II brought about the creation of the unity organization known as Engineering Joint Conference in 1941. Because of its tremendous success toward serving the government and the engineering profession, EJC, renamed the Engineers Joint Council, was expanded into the group we look upon as our unity organization. Between 1945 and the present time, our professionalism has been greatly furthered nationally through EJC's efforts.

The Taft-Hartley Act gives the professional engineer protection against the lures of trade unions and yet allows him to bargain collectively with other members of the profession. Surveys on the economic position of professional engineers have been assembled and published. Constant surveillance of professional classifications and salaries within U.S. Civil Service is provided. A national law has been passed which designates engineering as one of the learned professions along with law, medicine, and theology. At the request of the government, engineering reports have been prepared covering conservation, the development and use of the nation's water resources, and the industrial disarmament of Germany and Japan. These and other noteworthy accomplishments are to the credit of EJC.

We are maintaining our place at national and international conference tables of professional people through the activities of our unity organization, EJC. Provisions also have been made through this organization to maintain and develop our profession technically.

However, as individuals, we are most anxious to see some assistance and improvement shown in our relative economic position. Little has been done by EJC to improve this condition directly. Certainly we can understand that improvement of professional conditions and elevation of our profession in public opinion will improve our economic position, but it is necessary for the head of any family to be directly concerned and active in furthering the economic welfare of the individual members of his family. This direct activity for individual economic improvement would do much to raise the morale within the family. Certainly a public indication that EJC can do nothing directly to improve our economic position as individuals would severely damage our enthusiasm for EJC. Assisting in the economic betterment of both the employers and the employees of the profession should be a constitutional provision.

We are a big family. We have problems other than national and international. We must have economic and professional recognition locally. We must give the local citizens the advantage of a strong engineering family opinion. To date, EJC has not been equipped to supply this need. It is within its scope to provide regional families as non-voting affiliates, which will be in closer contact with local problems.

Local unification brings several thoughts to mind. First, formation of a local family which can speak with authority from the national unity organization and the local sections of all the societies, will have the same effect on state and local governmental agencies as EJC has had at the national and international level. It will give us strength in numbers to protect us from adverse state and local legislation, and it will raise our professional standing within the community. Most important, it will give the members of our engineering family who are not aware of national unification efforts, the opportunity to see what is being done and has been done for them by their societies.

Any adverse features of regional

unification are not insurmountable. Certainly the advantages more than outweigh the disadvantages. The committee structure of EJC lends itself to rapid action. Let's hope that plans for acceptance of regional groups as members of EJC will come to light in the near future.

The main objective we, as members of the engineering family, have is to take pride in the fact that we are members of our family. It is our professional duty to contribute toward a successful national and regional unification program. With acceptance of the fact that direct economic betterment of both the employer and the employee is a basic requirement, and that assistance should be given to the unity program, we will elevate our technical, professional, and economic position.

Utopia

HODGE GAINES, J. M. ASCE

Coordinating Design Engineer, Hillman and Nowell, Structural Engineers, Los Angeles, Calif.

It is fitting that utopia should be the culminating topic of our panel discussion since it is the ultimate goal of any philosophic, political or economic system. Utopia is defined as a concept of an ideal state or a visionary plan for social reform. The work of our Salary Committee has been to collect ideas, opinions, and particularly facts needed to forge the weapons with which to create an engineering utopia.

Can a professional utopia become a practical reality? Is an omnipotent engineering society possible in our complex social structure? Can the engineer become the community's first citizen simply because he is an engineer? Can professional engineers command the highest incomes because they are engineers? Can engineers become ultra successful citizens as the rule rather than as the exception?

Undoubtedly such a utopia is not completely achievable, and any genuine hope for it is indeed visionary. We should not, however, cease to expend every effort to improve our status. We must remove our heads from the clouds of complacency and indifference and seek answers to our real problems with vigor.

In the preceding panel discussions, two avenues for the advancement of the engineer have been discussed. They are by no means the only possibilities, but they are the two most widely considered by members of the engineering societies. Even though we realize that there is no immediate prospect of achieving a professional utopia, we must still continue our efforts to better the position of engineers. At the present time, both avenues are being pursued with varying degrees of success. Both have shortcomings. Both fail to meet the economic and professional needs of enough engineers. It is the purpose of this committee to find ways of improving these two paths, and equally important, to try to discover new avenues for the accomplishment of our purpose.

If collective bargaining is to be sanctioned or even recognized by the professional societies, it must be maintained on a high professional and moral plane consistent with the high ethical standards set up by the societies of which ASCE is one. Unionization would tend to split the engineering profession into two separate groups—employers and employees—which is especially undesirable in a family group struggling for professional unity. Because of the restrictions in the Taft-Hartley Act, none of the professional societies can take a leading role in collective bargaining or unionization since they include both employers and employees. For these and other reasons, this panel feels that collective bargaining, as we know it today, will solve the engineer's economic and professional problem only under certain circumstances.

Discarding unionization as the complete solution does not necessarily mean that the unity path is better. In the first place, we have not yet been able to form a real unity organization which includes all the engineers in the country. Only 170,000 engineers from a total of eight societies are represented in EJC. Not included are some 85,000 engineers who are members of other societies such as NSPE, IRE, and ASHVE. Even the sum of these two figures probably does not constitute a majority of the engineers in the nation. Can EJC then be an effective spokesman for the engineering profession?

The unity organizations have done many things for the advancement of engineering as a profession, but little direct work to elevate the economic status of the engineer. Thus, as the situation now stands, the unity organization is not the complete solution to our problem of achieving a professional utopia.

Where then can we turn? Where can we find the machinery necessary to achieve our engineering utopia? Perhaps by utilizing both unions and unity we can accomplish our purpose. Perhaps a highly professional union can function for the good of the professional employee when it is applied to local circumstances and specific cases. The unity organization must either accept unions in whatever form they may arise, or take steps to insure that engineering unions will be highly professional, or it must check this rising desire for unionization with a positive program for economic improvement. There are many methods by which this can be done, such as advocacy of higher engineering fees and salaries; a change in the tax status of the engineering societies to allow a more direct and active legislative lobby; a high-gear publicity program; restricted education; and stronger local section activity. It would seem that the unity groups have more opportunities for direct and practical action and have the natural advantage of being a part of the profession already.

It is our firm belief that the engineer is in a lower economic bracket than the members of our sister professions, and even lower than some non-professional craftsmen. This is not a biased opinion; it is the result of much study by this committee. Is this economic equity a justifiable end for the engineer? Does the engineer deserve to remain on the lower rungs of the ladder of professional success? Can the engineer ever reach his desired utopia? The answers to these problems will not appear as gifts, nor will they come from the work of a few members of a committee. They will only result from the concerted effort of all engineers and all their societies. It is up to all of us to help solve these important professional and economic problems.

Will you choose a completely new path, or will you elect to develop and expand the good features of the two outlined in this symposium? It appears we have no other alternative—either we will have unions or a unity structure with a strong economic program. Will you take unions or unity in your struggle toward utopia?

Longest vehicular bridge

WILLIAM H. SMITH, M. ASCE

Construction has started on the Greater New Orleans Expressway, a toll revenue project that includes the longest highway bridge in the world, a 24-mile structure crossing Lake Pontchartrain (Fig. 1).

Work orders were issued on January 20, 1955, by the Greater New Orleans Expressway Commission covering the Lake Pontchartrain Bridge and the south approach roads, following deposit on that day of the proceeds of the $46,000,000 bond issue. Ground-breaking ceremonies were held on February 12. The work order for the north access roads is being deferred pending acquisition of rights-of-way.

A joint undertaking of the Parishes of Jefferson and St. Tammany of Louisiana, the Greater New Orleans Expressway is under the authority of an amendment to the Constitution of Louisiana, Act No. 90 of 1952, approved by the voters in November 1952. This Act made available for the project a portion of the funds that had accumulated in State Highway Fund No. 2, and of future credits to this fund, for preliminary engineering expenses, for approach roads, and for annual allocations to supplement toll revenues in paying the principal and the interest on the bonds. This fund is credited with collections by the State of Louisiana of registration fees for automotive vehicles

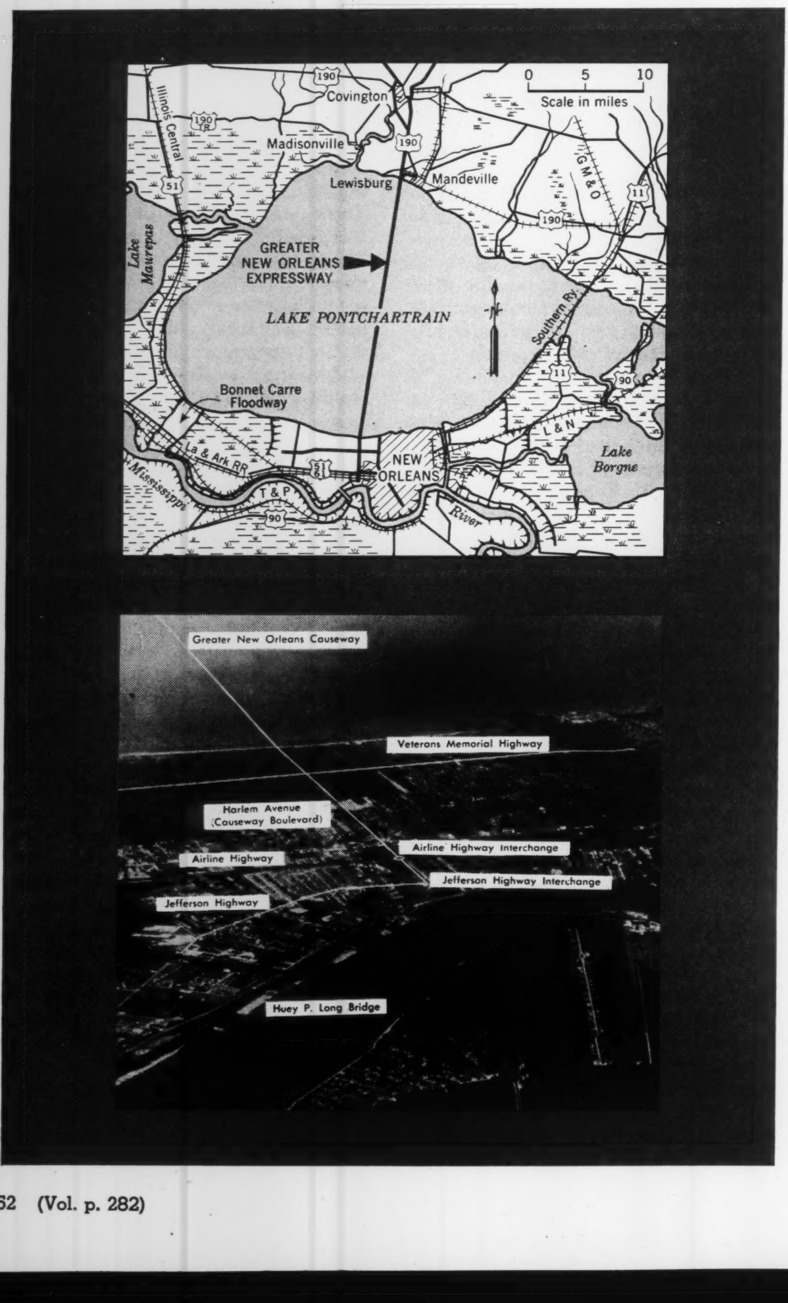

190
Covington
0 5 10
Scale in miles
Illinois Central
190 TR
Madisonville
190
Lewisburg
Mandeville
GM&O
11
51
190
Lake Maurepas
GREATER NEW ORLEANS EXPRESSWAY
LAKE PONTCHARTRAIN
N
Southern Ry.
Bonnet Carre Floodway
11
90
La & Ark RR
L&N
Lake Borgne
Mississippi
61
NEW ORLEANS
T&P
90
River
Greater New Orleans Causeway
Veterans Memorial Highway
Harlem Avenue (Causeway Boulevard)
Airline Highway
Airline Highway Interchange
Jefferson Highway Interchange
Jefferson Highway
Huey P. Long Bridge

FIG. 1. World's longest vehicular bridge, on the Greater New Orleans Expressway, is now under construction across Lake Pontchartrain. Connecting New Orleans with north side of lake—only direction in which city can expand—structure extends 24 miles over water.

starts across Lake Pontchartrain

Vice President and Chief Engineer, Palmer and Baker, Inc., Mobile, Ala.

in the six parishes in the vicinity of New Orleans.

The Greater New Orleans Expressway extends from Jefferson Highway (U.S. 90) northward to Lake Pontchartrain, a distance of 4.0 miles, thence across the lake on a prestressed concrete bridge 24 miles long, then north 2.7 miles to the Covington Highway (U.S. 190 and 34), with branches eastward and westward to U.S. 190 toward Mandeville and Madisonville respectively. See Fig. 1.

World's longest highway bridge

In both length and design, the Lake Pontchartrain Bridge is unique. Its 24-mile length will make it the longest highway bridge in the world, the only longer structure on record being the 30-mile railroad trestle across Great Salt Lake. The bridge is 33 ft wide overall and provides a two-lane roadway 28 ft between curbs, permitting two-way traffic past a stalled car. The design includes narrow emergency footwalks and concrete curbs surmounted by aluminum handrails.

Located approximately at the third points of the bridge are two bascule spans providing a 75-ft horizontal clearance between fenders. Midway between the bascule spans, and between each bascule span and the nearer shore (Fig. 2), are three fixed humps providing auxiliary channels with 56 ft between fenders and a 25-ft vertical clearance. A grade separation turnaround structure, permitting U-turns in either direction, is located about 9 miles from the south shore.

It was essential that the bridge be designed for low initial cost, a high degree of permanence, and extremely rapid construction to limit the amount of the bond issue and the interest during construction, as well as the annual maintenance cost. Since Lake Pontchartrain is subject to sudden squalls, fog, and rough water, it was considered advisable to minimize the amount of work that would have to be done on the lake. The large number of identical spans dictated that the design be adapted to mass production methods.

These considerations led to the adoption of a design for the typical bents consisting of two 54-in. cylindrical, hollow, prestressed-concrete piles; a precast pile cap, with the joints between the piles and the cap cast in place to obtain a rigid joint; and a pretensioned concrete superstructure of 56-ft span, precast in one piece of full width and length (Fig. 3).

Bids were also taken on an alternative design consisting of the three-span continuous elements, with 80-ft spans, using welded steel girders, with steel floor beams and stringers and cast-in-place concrete deck. The two lowest bidders quoted only on the prestressed concrete design, and the award was made to the lowest bidder.

Prestressed concrete piles

The prestressed concrete piles are of a type developed by the Raymond Concrete Pile Co. (See "Prestressing Warrants Study to Simplify Construction Methods," by Maxwell M. Upson, Civil Engineering, January 1953.) In the 36-in. size they have been used successfully on a number of projects in the Gulf States and for offshore oil drilling operations. A pile of 54-in. diameter was proposed after careful study by Palmer and Baker, Inc., as best meeting

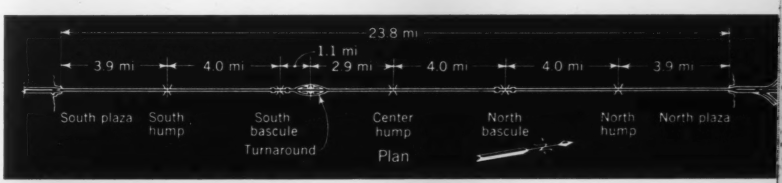


FIG. 2. Navigational clearance is provided by two bascule spans and three fixed spans with vertical clearance increased to 25 ft.

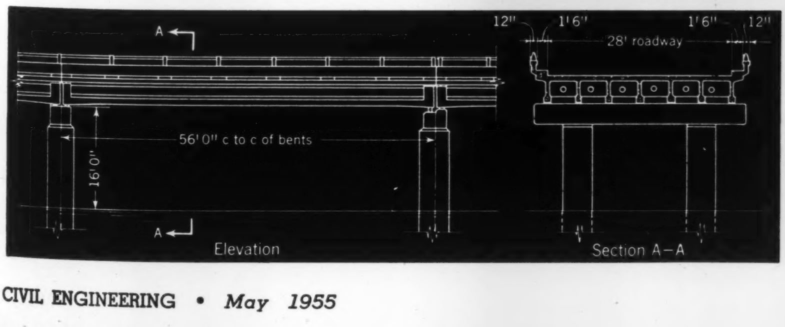
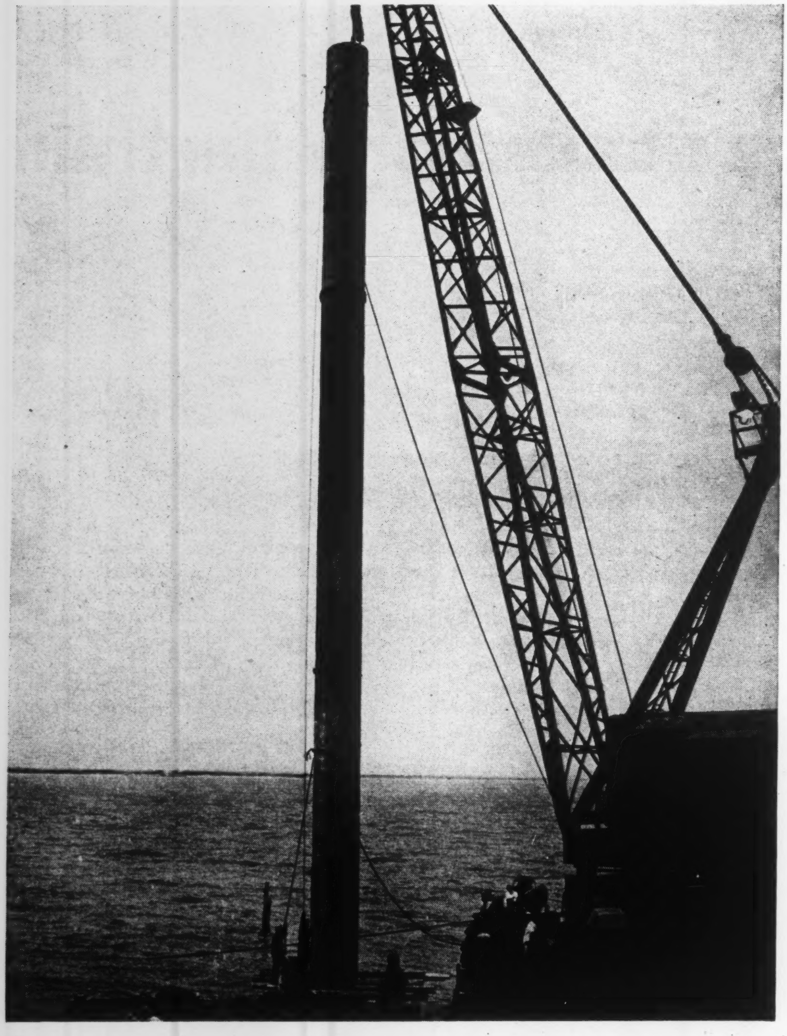


FIG. 3. Entire roadway section, except handrails, is precast and carried to site by barge. Placement is by special traveler crane moving on completed section of bridge.



Prestressed concrete test pile is positioned for driving. When test load of 420 tons was applied to this pile, total settlement was 0.41 in. and residual settlement after removal of load was 0.13 in. Design load per pile is limited to 140 tons. Hollow piles, of 54-in. diameter and anticipated average length of 86 ft, are centrifugally cast.

the requirements of this project. The Raymond Concrete Pile Co. successfully developed equipment and techniques for manufacturing and driving these piles of unprecedented size.

For most of its length, the bridge is over water about 15 ft deep. Below the bottom, soft mud extends on the average for a depth of 25 ft, underlain by 30 to 40 ft of denser sedimentary deposits of recent geological formation. The piles will be driven to Pleistocene strata consisting of sand, dense clay, or mixtures of sand, shell, silt, and clay of excellent supporting power at average depths of 72 ft below the water surface. It was because of the relatively long unsupported length that the large pile diameter was specified.

A test pile driven at the site, about 1.5 miles off the south shore, supported a load of 420 tons with a total settlement of 0.41 in. and a residual settlement after removal of load of 0.13 in. The design load on the piles has been limited to 140 tons.

These piles are manufactured in hollow sections normally 16 ft long, with 12 cored holes for the introduction of high-tensile wire and with a wire spiral and auxiliary longitudinal reinforcement of conventional type in place. The concrete shell is 4 in. thick. Concrete for the piles is specified to have a minimum of 6 bags of cement per cu yd, with aggregate of 1-in. maximum size, a maximum water-cement ratio of 6.00, and a slump of 3 to 5 in., with a compressive strength equal to or greater than 3,500 psi at 7 days and 5,000 psi at 28 days. These figures are only nominal. The compacted concrete actually will have a negative slump and a very low water-cement ratio after centrifugal casting, vibration, and rolling. The high-tensile wire is of 0.192-in. diameter, oil-tempered steel spring wire, ASTM designation A 229, with a maximum ultimate strength not exceeding 240,000 psi.

High-strength concrete produced

The sections are spun on a special centrifugal casting machine as soon as the concrete is introduced, and are simultaneously vibrated and rolled so that excess water is forced to the inside, and an extremely hard, dense concrete of high strength is obtained. After steam curing and then air curing, the cores are removed. A 28-day concrete strength of 8,000 psi or better is anticipated.

Next the sections are assembled in line as required, using a special high-strength thermoplastic seal at the joints. The high-tensile wire is inserted in the cored holes and tensioned to 150,000 psi, and the cores are grouted full. Tension is released after the grout has attained ample strength to hold the wires without slippage.

The piles will be cast ashore, transported to the site on barges, and driven with a special Raymond 0000 hammer, developing an energy of 58,000 ft-lb. A special template will be used to assure accurate positioning of the piles.

Pile caps, of conventional reinforced-concrete design, will be precast ashore, transported to the site, set accurately in position, and rigidly anchored to the piles by a cast-in-place shaft extending into the pile and through the cap, with a cage of reinforcement.

The superstructure consists principally of 56-ft spans with a concrete slab and seven girders of I-shape. Longitudinal reinforcement is pretensioned. Concrete is specified to have a minimum of 8 bags of cement per cu yd, with aggregate of $^3/_4$-in. maximum size, a maximum water-cement ratio of 4.50 and a slump of 2 to 4 in., with an intended compressive strength at 28 days of not less than 5,000 psi. Pretensioning reinforcement consists of 25 strands per girder of $^3/_8$-in., 7-wire strand, having a minimum breaking strength of 20,500 lb and a yield strength, measured by the 0.2 percent offset method, of 16,500 lb.

Three casting beds have been constructed, each accommodating eight spans. Movable steel forms for 24 spans have been provided. These forms are designed so that after the concrete has hardened, the forms on each side of each girder can be retracted down and away from the face of the concrete by means of a screw mechanism with right- and left-turn threads.

Finishing of the roadway surface, true to profile and cross section, will be accomplished by a finishing machine operating on an elevated track outside the forms. The necessary adjustments are provided to compensate for upward deflection of the slabs when the pretensioning stress is released. The track structure is of reinforced concrete and participates in resisting the tensioning thrust.

Strands for each line of girders will be placed by means of a "swift" car handling 25 reels of strand, anchored to a fixed abutment at one end and attached to the jacking head at the other abutment. The swift car is a simple flat car, traveling on short transverse tracks, on which 10 vertical spindles, each carrying either 2 or 3 reels of strand, are mounted. The swift car will be moved successively to the six other girders. The strands will be tensioned by hydraulic jacks to 12,800 lb per strand.

Spans cast and cured

Each span will be cast in its entirety in one continuous pour, including sidewalks and curbs. After the concrete has been placed, it will be air and steam cured to obtain a strength of 3,000 psi in less than 3 days. The tension in the strands will then be released gradually to avoid shock, and the strands cut at the ends of each span of the eight on the casting bed.

Next the spans will be transported by a 200-ton gantry to a slip, where they will be placed on barges and towed to the bridge. The spans will be placed in position on the caps by a special erector traveling on the previously completed superstructure. Work will be carried forward progressively from north to south, and temporary trestles will be provided at the humps and bascule spans to transfer the erector across these sections where special construction is required.

Except at the bascule spans and other points where special in-place construction is necessary, the only work to be performed on the bridge after the precast and prestressed elements are in place will be the placing of the aluminum handrail and electrical wiring.

North and south approaches

The south approach road included in the contracts will be a four-lane divided highway, located on available right-of-way. Because of the poor subsoil conditions, construction of this highway will involve excavating peat to an average depth of 5 ft, backfilling to subgrade elevation with sand fill obtained from Bonnet Carre Spillway 15 miles away, and consolidation with a temporary surcharge fill. The pavement will consist of $2^1/_2$-in. asphaltic concrete, laid in two courses on an 8-in. sand-shell subbase.

Twin bridges of conventional reinforced concrete design will be constructed over the three main drainage canals crossed by the highway.

The north approach roads will include a total of 6 miles of four-lane divided highway, on new rights-of-way. The pavement will consist of an 8-in. unreinforced concrete slab on compacted subgrade. Two twin bridges of conventional reinforced concrete design will be constructed at the crossings of the north and west branches over Bayou Chinchuba.

Plans are under way for supplementary improvements partly under the bond issue and partly under a direct allocation of $5,000,000 from Road Fund No. 2. These include the extension of the south approach road to Jefferson Highway, with a 4,000-ft overpass over Metairie Boulevard, Airline Highway, and two groups of railroad tracks; a grade separation interchange at Airline Highway; a hook ramp at Jefferson Highway to provide grade separation for left turns to and from the Expressway; the extension of Veterans Memorial Highway from the Jefferson Parish line to Pontchartrain Boulevard in Orleans Parish; and a bypass around the city of Covington, La.

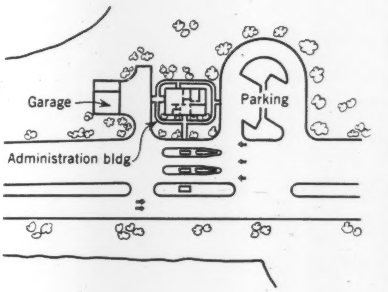


FIG. 4. Toll plazas will be placed at both ends of the bridge, and all vehicles will pay as they enter structure. Three toll booths will be provided at each plaza.

Toll collection provisions

Tolls will be collected at both ends of the bridge from vehicles coming onto the bridge. Vehicles desiring to go only to the turnaround and return will pay the same toll as for the full one-way trip across the bridge. The toll plazas will be located on the approaches inshore from the bridge abutments. There will be three toll booths at each plaza (Fig. 4). An administration building, garage, and maintenance shop will be constructed at each plaza adjacent to the toll booths.

Contracts for the bridge and the north and south approaches were awarded in July 1954 to the Louisiana Bridge Co., a joint venture consisting of Brown & Root, Inc., of Houston, Tex., and T. L. James & Co. of Ruston, La. Contract prices were as follows:

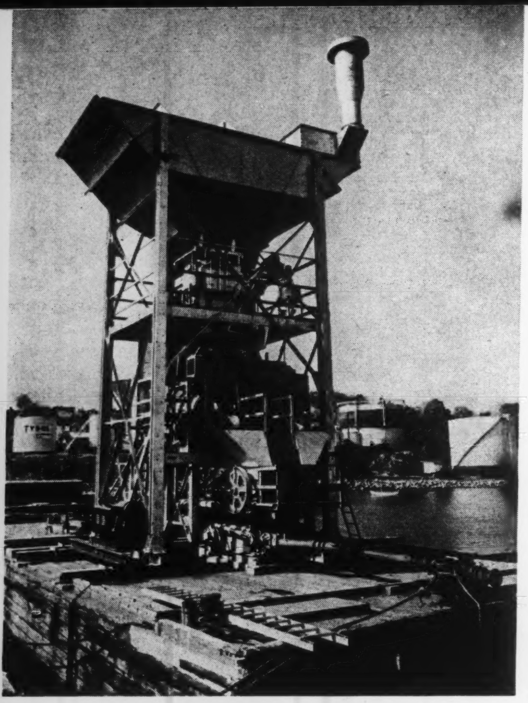
CONTRACT NO.	STRUCTURE	AMOUNT
65	Lake Pontchartrain Bridge	$27,600,000.00
65-1	Approaches, South Shore	2,043,937.33
65-2	Approaches, North Shore	1,033,272.81
	Total	$30,677,210.14

The first contract listed was on a lump-sum basis, the other two on a unit-price basis. The project is being administered for the two parishes by a commission of five members, with Hon. John J. Holtgreve, President of the Jefferson Parish Police Jury, as chairman.

Palmer and Baker, Inc., consulting engineers of Mobile, Ala., have performed all the engineering services on the project and are supervising construction. Wayne F. Palmer, M. ASCE, President, and Rear Adm. William H. Smith, M. ASCE (CEC) USN (Ret'd), Vice President and Chief Engineer, have been in general charge of the engineering work. K. C. Roberts, M. ASCE, Assistant Chief Engineer for Design, was in immediate charge of plans and specifications. Rear Adm. L. N. Moeller, M. ASCE (CEC) USN (Ret'd), Assistant Chief Engineer for Construction, is in immediate charge of construction, with Brig. Gen. J. J. Twitty, CE, USA (Ret'd), as Resident Engineer.

J. E. Walters, Project Manager, is in overall charge of the project for the contractors, with D. W. Milhan, A. M. ASCE, as Project Engineer, and J. E. McWhorter as Project Manager for T. L. James & Co. on the south approach roads.

The project is scheduled for completion by January 1, 1957.



Pumped concrete . . .

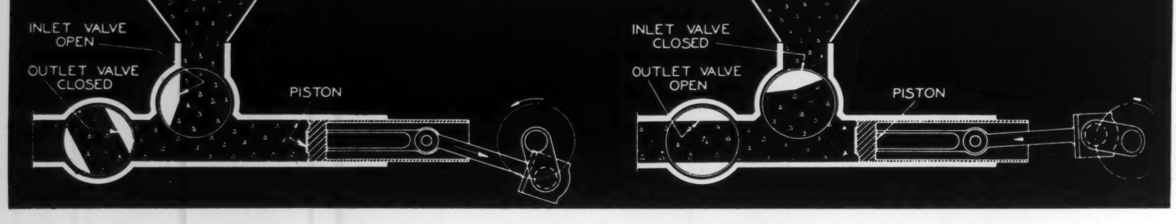
economical on wide variety of projects

R. V. KRIKORIAN

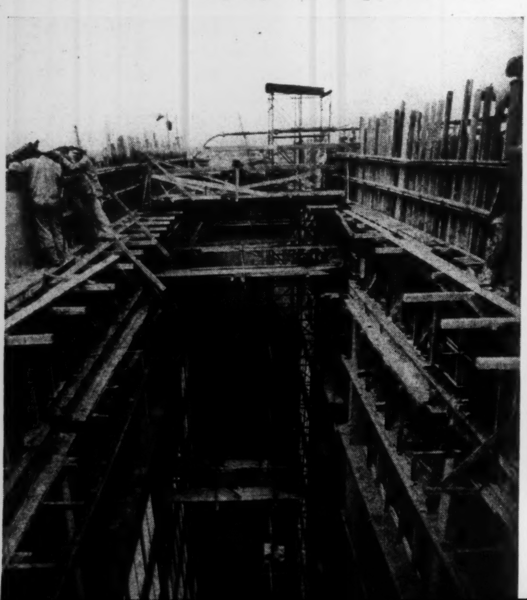
Assistant Sales Manager, Chain Belt Company, Milwaukee, Wis.

For pier job on Hudson River, dual Pumpcrete fits under central mixing plant mounted on barge. Job was done by Merritt-Chapman Scott for Port of New York Authority.

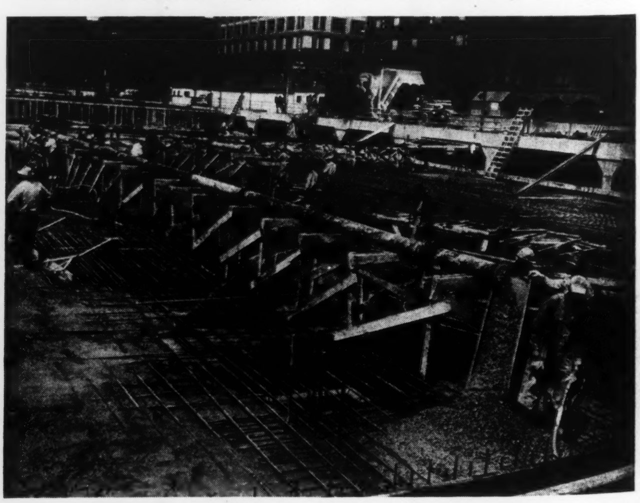
FIG. 1. Pumpcrete operates on two-stroke pattern. On suction stroke (below left), inlet valve opens to allow charge of concrete to fall from hopper into cylinder. Inlet valve then closes. On pressure stroke (below right) outlet valve opens and piston expels concrete through outlet valve into pipeline. Opening and closing of plug valves are synchronized with movement of piston.



Pumpcrete machine in basement of new "twin-pigeonhole" parking garage in Denver, Colo., places tenth-floor slab 120 ft above. This garage was completed in 1953.



Wide-area slab for parking garage in Chicago, Ill., is placed by Pumpcrete. On this job, done for City of Chicago by contractor Herlihy Mid-Continent Construction Co., there was no need for runways and buggies.



Some construction men believe that it takes a mass concrete job with many thousands of cubic yards of concrete to justify the use of Pumpcrete. Others will state that the principal advantage of this method is realized in tunnel lining work only. Both limitations are erroneous. The Pumpcrete and pipeline concreting method has been used on almost every type of concrete construction in the United States and foreign countries. This includes jobs ranging from as little as 50 cu yd of concrete to projects involving in excess of a million cubic yards. Notwithstanding this fact, there is still a question in the minds of many construction men regarding the type of concrete job this equipment can be used on to economic advantage.

Pumpcrete has become standard concrete placing equipment for many hundreds of organizations on such diversified work as commercial and industrial buildings, wide-area plants, power developments, dams, spillways, bridges, grade separations, filtration and sewage treatment plants, tunnels—in short, the entire range of general construction.

The Pumpcrete is a positive displacement reciprocating pump with component parts timed in direct relation to each other, and designed to pump concrete. All Pumpcretes are equipped with a remixer mounted over the inlet valve which also serves as a storage hopper.

Pumpcretes are available in three different sizes and models. The 160 Single, mounted either on skids or pneumatic tired wheels, utilizes a 6 $^5/_8$-in. OD pipeline and has a capacity of 15 to 20 cu yd per hr. The 200 Single and 200 Double, mounted on skids, utilize an 8 $^5/_8$-in. OD pipeline and have capacities of 27 to 33 cu yd per hr and 55 to 65 cu yd per hr, respectively. All Pumpcretes are powered by a choice of electric or gasoline engines. Recommended pipeline distances are 800 ft horizontally, or 100 ft vertically for the Model 160, and 1000 ft horizontally or 120 ft vertically for the 200 Single or 200 Double.

The important factor that determines Pumpcrete's suitability for a particular job, regardless of type or size, is the accessibility of the forms in relation to the point at which concrete is mixed or delivered. Any time a Pumpcrete can be utilized for the transportation, elevation, and distribution of concrete in one operation in such a manner that it eliminates rehandling equipment and preparatory work, and reduces labor cost, it will show an economic advantage.

Pumpcrete has been applied to a wide range of jobs—both large and small—with definite economic advantage to the contractors. This advantage varies from one job to another because of the wide range in types of work and in methods of application. All jobs will vary with local labor and freight rates, job conditions, weather conditions, union regulations, and many other factors. To say that concrete can be placed with a Pumpcrete for 30 cents per cu yd or $3.30 per cu yd is to say nothing unless particulars are known. Placing costs are always relative and therefore must be determined separately for each individual job.

Our first step is to evaluate the job so as to determine whether or not the Pumpcrete and pipeline method will prove suitable. This can be done by securing answers, which are readily determinable, to a number of well-defined questions. We need to know:

1. What type of job is involved? That is, is it a building, tunnel, or warehouse?

2. What are the overall dimensions of the structure or extent of the project?

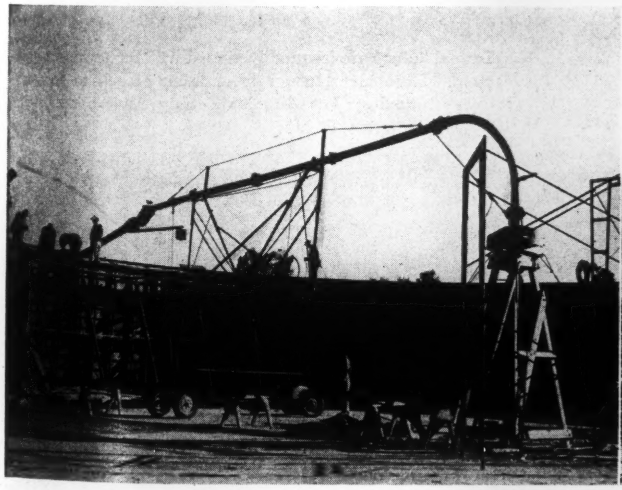
3. What hourly rate of placing concrete is required?

4. What is the total volume of concrete involved?

These are elementary questions regarding the job, which can be easily answered. Some additional questions are now in order, and on the answers to them will depend the decision as to whether Pumpcrete is in or out of the picture. Here are the remaining questions:

5. What is the construction schedule, that is, how long will the job last? It is also desirable to know the disposition of the concrete and in what order form work will be advanced. Whether the operations can be carried out in progressive sequence or whether the schedule calls for widely scattered pours over a large area, could make a big difference in whether or not Pumpcrete would be economical.

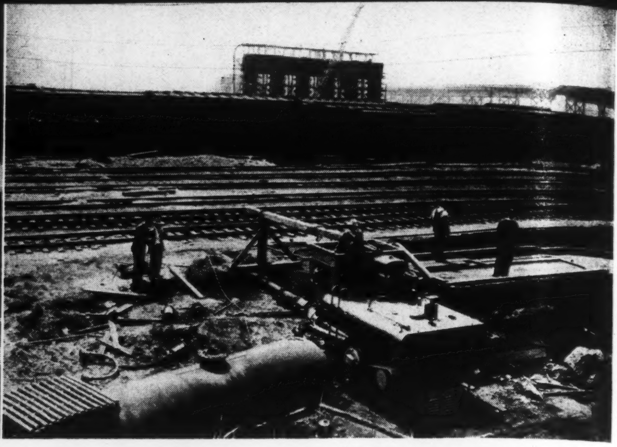
6. How will the concrete be produced? This is a most important detail. If it is to be truck mixed concrete that can be deposited directly into the forms without rehandling, this could eliminate Pumpcrete from consideration. However, in some cases economical batching and mixing arrangements might be effected by a pipeline setup. It is often possible to locate a central plant on vacant property, or next to an existing railroad siding, or on a steep slope several hundred feet away from the



Crew of 8, using Pumpcrete with swivel-jointed pipe and dolly, place concrete in 100-ft-dia. tank for Grand Rapids, Mich., sewage plant. Barnes Construction Co. completed work in 1954.

On housing development in Euclid, Ohio, a suburb of Cleveland, Epstein Construction Co. used Pumpcrete to eliminate need for truck roads in muddy terrain.

Using traveling jumbo, this small crew placed concrete floor slab 40 ft wide and 500 ft long for Chrysler tank plant in Newark, Del., in one day with Pumpcrete and pipelines. Contractor was H. K. Ferguson.



Concrete is pumped under 13 active tracks to viaduct piers 500 ft away, beyond freight cars, by 200 Double Pumpcrete machine in foreground. Job in Newark, N.J., was done by Franklin Construction Co.

work site for gravity truck delivery of aggregates.

7. Can costly preparatory work be eliminated? For example, in order to place the concrete from truck mixers directly in the forms, it might be necessary to construct a trestle or build a special road into the project, which might have to be maintained at high cost owing to bad ground or some other disadvantage. If Pumpcrete will eliminate these preparatory costs, the saving will be a big point in its favor.

8. What alternate method or methods of concreting are proposed? This information is always necessary in order to make a cost comparison.

9. Does the prospective user own the equipment for the alternate methods contemplated? This point can make a big difference and must enter into the estimate when final costs are added up.

The answers to these nine questions will quite clearly show whether or not Pumpcrete can be used to advantage on a given job.

Different organizations handle their allocation of concreting costs in different ways. Some organizations charge only the actual labor required during the hours of placing. Other organizations include everything in sight and then add a healthy contingency factor.

Concrete placing costs are here assumed to consist of fixed charges, operating costs, and labor costs, as follows:

1. **Fixed charges** include the cost of all equipment involved in the placing of concrete, such as write-off on investment or rentals, freight on all equipment to and from the job, the cost of installing and removing all equipment, and any required construction of roads, trestles or other preparatory work necessary for concrete operations.

2. **Operating costs** cover the maintenance and operation of all equipment.

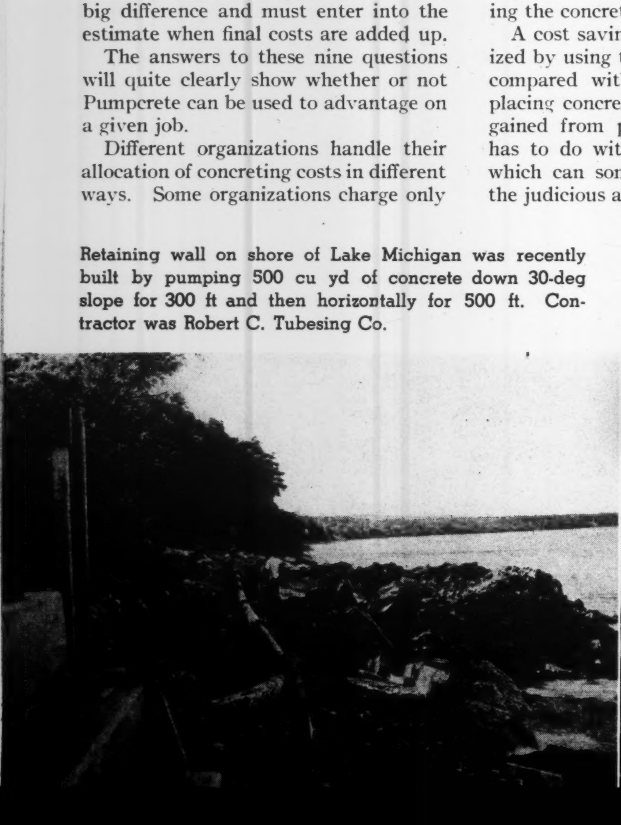
3. **Labor costs** cover the man-hours required for transporting and distributing the concrete.

A cost saving that will often be realized by using the Pumpcrete method as compared with any other method of placing concrete on a given job is that gained from pipeline flexibility. This has to do with construction schedules which can sometimes be advanced by the judicious application of pipeline distributing methods which reduce overhead and general expenses. It is made possible by achieving closer coordination between the allied trades on structures which lend themselves to a repetitious sequence of operations. This would apply to most building jobs, viaducts, bridge piers and decks, sewage and water treatment plants, locks, dams, power plants, waterfront work, and all tunnels requiring poured concrete lining.

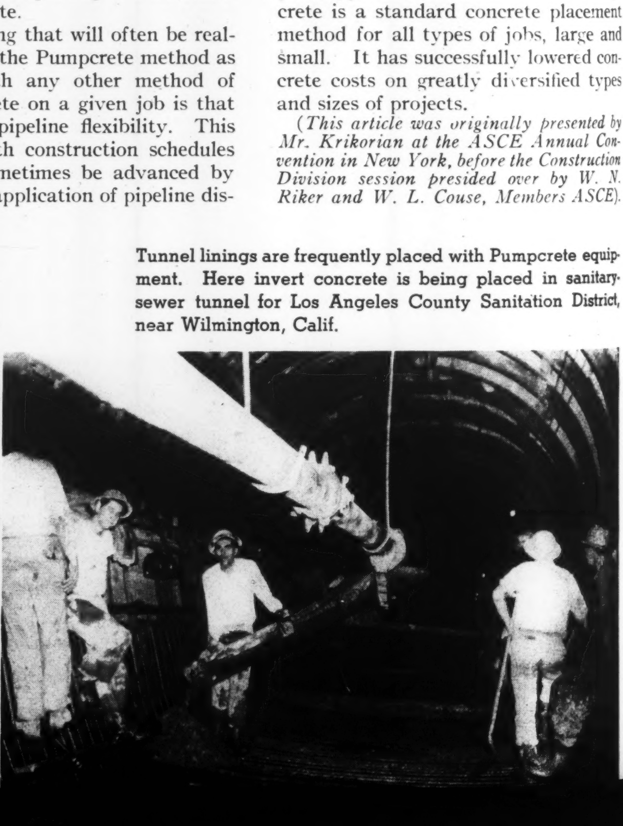
There is no one best method for placing concrete on all jobs. The Pumpcrete method—concrete by pipeline—has certain advantages which make it particularly adaptable in specific instances. It should be recognized, however, that it does not rely on its particular advantages on the majority of placing jobs on which it is used. Pumpcrete is a standard concrete placement method for all types of jobs, large and small. It has successfully lowered concrete costs on greatly diversified types and sizes of projects.

(*This article was originally presented by Mr. Krikorian at the ASCE Annual Convention in New York, before the Construction Division session presided over by W. N. Riker and W. L. Couse, Members ASCE*).

Retaining wall on shore of Lake Michigan was recently built by pumping 500 cu yd of concrete down 30-deg slope for 300 ft and then horizontally for 500 ft. Contractor was Robert C. Tubesing Co.



Tunnel linings are frequently placed with Pumpcrete equipment. Here invert concrete is being placed in sanitary-sewer tunnel for Los Angeles County Sanitation District, near Wilmington, Calif.



ENGINEERS' NOTEBOOK

J. W. HOWE, M. ASCE, Professor and Head of Department

G. C. SHIEH and ARTURO OBADIA, J. M. ASCE, Graduate Students

Department of Mechanics and Hydraulics, State University of Iowa, Iowa City

Aeration demand of a weir calculated

A familiar statement regarding the installation of standard sharp-crested weirs is that they must be "properly aerated," the reader being left to determine for himself the venting arrangement which will be "proper."

Aeration of a weir is necessary because of the entrainment of air beneath the nappe by the falling water. Unless this air is replaced as fast as it is carried away, the air in this space is gradually evacuated and the pressure reduced to values appreciably below atmospheric. As the pressure is reduced, the discharge coefficient of the weir is significantly increased.

Aeration demand studied

Tests to determine the magnitude of the aeration demand were made by the junior authors in the laboratory of the Iowa Institute of Hydraulic Research, using sharp-crested weirs varying in height from 2.0 to 3.5 ft, with heads up to 1.1 ft. A rectangular flume having a level floor was fitted with an arrangement permitting air to be fed to the space beneath the nappe at the rate necessary to keep the pressure in this region atmospheric. The rate at which air was supplied was measured using orifices and a delicate differential (Wahlen) gage.

The air demand of the weir is a function of the weir height, the head on the weir, and the tailwater level, inasmuch as the velocity of the water is dependent upon the total height of fall, and the area of the air-water interface is related to tailwater elevation. The maximum demand for a given weir thus develops when the head is greatest and the tailwater depth is least.

In the accompanying Fig. 1 the ratio of air demand, q_a, to the discharge over the weir, q_w, is plotted against the ratio of head, h, to weir height, w, for the condition of minimum tailwater level, that is, with supercritical velocity in the downstream channel. The amount of air needed to completely replace that removed by aeration is seen to increase rapidly with the ratio of head to weir height, reaching a maximum of 5 percent of the water discharge when the ratio approaches 0.5.

If air is to flow into the space under the nappe, the pressure on the outside end of the opening through the flume wall must be higher than that on the inside. Inasmuch as the air outside will ordinarily be at atmospheric pressure, a negative pressure must exist under the nappe. However, this difference can be made small if the opening is made sufficiently large.

Example solved

For example, assume that a weir 2.5 ft high and 3.0 ft long is to operate under a maximum head of 1.0 ft. Air is to flow through an orifice in one side wall, and the pressure under the nappe is to be not more than 0.001 ft of water below atmospheric. The size of the orifice is desired.

By the Rehbock weir formula,

$$\varsigma_w = \frac{2}{3}\left[0.605 + 0.08\,\frac{h}{w} + \frac{1}{305h}\right] \times L\sqrt{2g}\,h^{3/2}$$

$$q_w = \frac{2}{3}\left[0.605 + 0.08 \times \frac{1.0}{2.5} + \frac{1}{305 \times 1.0}\right] 3.0 \times \sqrt{64.4} \times 1.0^{3/2} = 10.2 \text{ cfs}$$

For the given ratio, $\frac{h}{w} = \frac{1.0}{2.5} = 0.4$; $q_a/q_w = 0.049$ (read from the curve of Fig. 1). Hence

$$q_a = 0.049 \times 10.2 = 0.50 \text{ cfs}$$

The flow through the orifice is then

$$q_a = C_d\, a \sqrt{\frac{2\Delta p}{\rho}}$$

If C_d is taken as 0.61, and ρ for air at 60 deg F as 0.0024 slugs per cu ft,

$$q_a = 0.50 = 0.61 \times \frac{\pi d^2}{4} \sqrt{\frac{2 \times 0.001 \times 62.4}{0.0024}}$$

From this,

$$d = 0.38 \text{ ft, or } 4.6 \text{ in.}$$

A similar computation can be made for other forms of air vents, using the proper flow relation for the quantity of air required and the desired pressure drop through the vent.

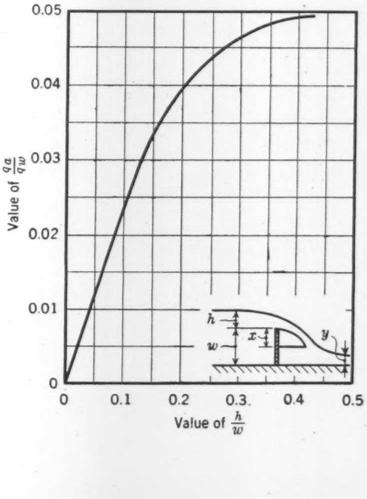


Fig. 1. Maximum air demand for sharp-crested weir can be read from curve of q_a/q_w (air demand to weir discharge) plotted against h/w (head to weir height).

THE READERS WRITE

Why oppose collective bargaining?

To The Editor: For some months Civil Engineering has entertained its readers with a series of anti-collective-bargaining articles initiated last summer with Stewart McCoy's "It Could Happen to You" (July 1954). In the February 1955 issue appears a report on the Engineers' Joint Council panel discussion, "Employment Conditions and Unionization—Their Effect on the Engineer." The chairman of this panel, Dr. Brooks Earnest, prominent ASCE member, is quoted with the following statement about members of ASCE, ASME, and AIEE who are not opposed to collective bargaining for engineers: "We are faced with the responsibility . . . of converting 30,400 of our members to true professional status." Since I am unopposed to collective bargaining, and am unlikely to recant voluntarily, I should like to present some defense for us 30,400 heretics before the more intransigent among us are burned at the stake for failure to profess the true professional faith.

In many anti-union arguments, collective bargaining organizations for professionals are called "labor unions" and assumed to operate in the same manner as trade or craft unions, leveling salaries and dampening initiative as these unions undeniably do. This myth is exploded in an article in the January 1955 issue of the *Consulting Engineer* magazine, "The Engineers' Unions Are Here," which reveals that Engineers & Scientists of America, for example, has fought salary leveling, consistently requesting percentage increases. APEP, an engineers' union at the Camden RCA plant, negotiates for individual merit salary increases which are in excess of across-the-board raises. As disclosed by the ASCE survey of 1953, only 1 percent of the respondents wanted to be represented by a craft or labor union. Thus it should be obvious that denouncing engineers' "labor unions" is an irrelevant and futile pastime, more apt to obscure than to clarify the problem.

A closely related myth is the belief that any engineer who would belong to a collective bargaining organization is "unprofessional" in some ambiguous, undefined sense. To quote E. Lawrence Chandler's remarks at the recent EJC panel, " . . . the essence of collective bargaining is . . . foreign to the basic concept of professionalism and to the fundamental thinking inherent in creative engineering."

I doubt that Mr. Chandler could produce any real reasons substantiating this conviction. Collective bargaining, in itself, is a purely economic practice. Its effect on professional qualities is another problem. Whether non-union engineers have higher professional integrity, work harder, and are more competent than union engineers is known with no more certainty than whether they are kinder to their mothers. As engineers, we should see the need for formulating criteria and making objective observations in order to produce any valid conclusions in this matter.

In my opinion, the retarded personnel policies of many large industrial concerns are largely responsible for the crushing of individual initiative so glibly attributed to engineers' unions. As one writer put it, the present employment trend is to treat engineers as "depersonalized units of mass administration." There is little or no effort in many companies to recognize superior talent and to give young engineers a sense of creative personal accomplishment. I quote from Charles Yoder's article, "What About Collective Bargaining?" (Civil Engineering for September 1954):

"Specialization becomes valuable to the efficient operation of a large group. To the individual, however, in so far as it retards full self-expression, it leads to narrowness and monotony. If to these you add a slower rate of advancement, the end product is individual frustration and dissatisfaction. This is a breeding ground for unionization."

Of course, there are those who would say to an engineer caught in such a situation something like, "Go West, young man!" However, this is simply dodging the issue, for there is another unlovely practice prevalent in industry—collusion between supposedly rival companies which agree not to hire one another's engineers except under circumstances compromising the employee. Wage data are exchanged and, in effect, a ceiling wage for various classes of engineers is established. Obviously, this corruption of economic power, even if practiced by only a small clique of companies in a given area, tends to destroy the free enterprise system in which an engineer employee sells his services on the open market. It seems strange that those who are so sensitive to the use of collective economic power by employees consistently overlook the use of even greater power by employers.

If the ASCE and EJC must continue devoting their energies to this problem I submit the following suggestions:

1. Publish no more anti-union sermons in Civil Engineering unless there is some factual basis for the writer's views. Mr. Yoder's article, "What about Collective Bargaining?" was an enlightening article; it contained information that clarified the basic issues. In contrast, Dean Clement J. Freund's article, "Employers, Ethics, and Young Engineers" (Jan. 1955), when it touched upon collective bargaining, was a futile airing of personal prejudice.

2. Conduct surveys of employment conditions in companies whose engineers are unionized. Get employers' and employees' opinions on the various effects of collective bargaining. Does it really dampen initiative, protect the incompetent, and encourage mediocrity? Does it contribute materially to the engineer's economic status?

3. Make a sincere attempt to evaluate the personnel policies of engineers' employers. Is the practice of making collusive agreements for the purpose of leveling engineers' salaries widespread? How many companies, because of retarded personnel policies, are literally inviting collective bargaining organizations to enter their doors?

Such a program would provide valuable information from which an objective appraisal of collective bargaining and employers' personnel policies could be made. By bringing the genuine issues to the fore it could not help being an improvement over the obscurantist propaganda campaign being waged at present.

C. W. Griffin, J.M. ASCE
Edwards & Green
Architects and Engrs.
Camden, N.J.

Editor's Note: Readership surveys indicated top interest in the three articles referred to above by Mr. Griffin. Mr. McCoy's article was first choice in the July 1954 issue; Mr. Yoder's was second choice in the September 1954 issue; Dean Freund's was first choice in the January 1955 issue.

Civil engineers needed in Southern Rhodesia

To the Editor: The Federation of Rhodesia and Nyasaland offers a vast potential for civil engineering enterprise and development, more especially in the provision of low-cost permanent housing and for the rapid and economic construction of roads.

The Government lately announced a plan to provide 6,000 houses for sale to Africans. There is also an acute shortage of low-cost permanent housing for Europeans. The building interests here are endeavoring to deal with the backlog and with existing and future requirements, but owing to the employment of traditional methods of building are not able to adequately cope with the problem.

Road construction and maintenance also are vital to the progress of the country. Here again traditional means are being used which are both costly and slow. The need is for cheap modern methods of house construction and economic and rapid methods of road construction, employing for the latter the latest soil stabilization techniques with bituminous emulsions and chemicals as stabilizers.

The Government is prepared to support and encourage development of this nature in the Federation. I will be grateful if firms interested in establishing organizations in the Federation, Salisbury for instance, to deal with these needed facilities, will write to me. I would gladly act as a liaison between interested parties and the Government or any departments concerned. If desired, I can supply prints of approved types of housing, soil maps of the country, or other information required.

A. C. Brennan-Craddock, A.M. ASCE
Consulting Civil Engineer

8-04, Trafalgar Court, King's Crescent,
Salisbury, Southern Rhodesia, Federation
of Rhodesia and Nyasaland

Italian contractors built Greek hydro projects

To the Editor: Certain errors that occurred in my article, "Greece Gets Nation-Wide Power System," in the January issue, should be corrected. Much of the work on the Ladhon and Agra hydroelectric projects, described in the article, was done by Italian subcontractors under the direction of the Società Edison of Milan, which designed and constructed these two projects, acting as general contractor.

To the Ladhon Project, one of the chief projects described in the article, belongs the Pidima Dam, of hollow concrete gravity type. Under a photo of this dam, it was erroneously stated that the dam was constructed by Greek contractors. Actually Pidima Dam was built by the Italian firm of Impresa Ing. Lodigiani, which also constructed the diversion dam, diversion tunnel, and about half of the power tunnel, as well as the surge tank, powerhouse, tailrace, and river rectification. Another Italian contractor, Impresa Ing. E. Recchi of Turin, built the other half of the power tunnel. This type of dam design, devised by Ing. Claudio Marcello, Technical Director of the Società Edison, has been used for several major Italian dams and offers various technical and economic advantages.

The Ostrovo tunnel and intake were carried out by Impresa Fratelli Garatti & Co. of Brescia, Italy, as subcontractor. The power tunnel, surge tank, penstock foundations, powerhouse and tailrace were built by Impresa Umberto Girola of Milan, Italy.

We are glad to correct these errors, and to give proper credit to the Italian contracting firms that did the major part of the construction work on these two hydroelectric projects. In addition, several Greek contractors were employed in doing various parts of the work.

Walter S. Merrill, M. ASCE
Chief Civil Engineer,
Athens, Greece *Public Power Corp.*

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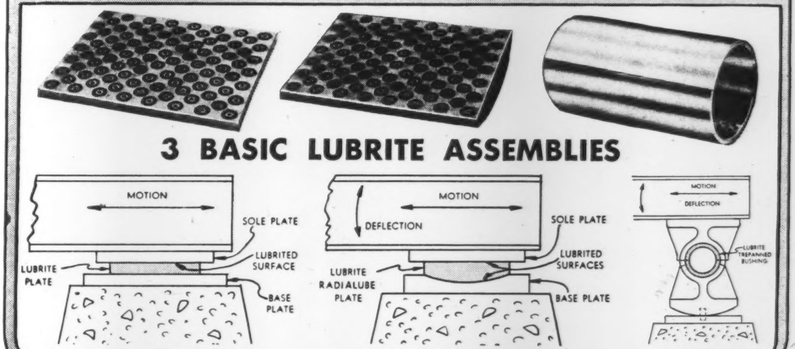

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St. Louis Convention

Sponsored by the St. Louis Section

Jefferson Hotel **St. Louis, Mo.** **June 13–17, 1955**

REGISTRATION

Mezzanine, Jefferson Hotel

Tuesday through Thursday, June 14–16, 8:30 a.m. to 5:00 p.m.

Friday, June 17, 8:30 a.m. to noon

Registration fee, except students and women, $3.00

ADVANCE ATTENDANCE INFORMATION

To assure adequate preparation to make your attendance at the St. Louis Convention most satisfactory, the committee requests your assistance. It is most helpful to have guidance in the number of persons to be expected for the various functions. Will you please use the coupon on page 118, which is to be sent to Joseph W. Graves, Jr., Registration Chairman, 3800 West Pine Boulevard, St. Louis 8, Mo.

There is no obligation attached to your use of this coupon. It can be very helpful to those planning the Convention, with your cooperation.

AUTHORS' BREAKFASTS

Jefferson Hotel

Tuesday, June 14, 8:00 a.m., Room 4

Wednesday, June 15, 8:00 a.m., Room 4

Thursday, June 16, 8:00 a.m., Room 3

Friday, June 17, 8:00 a.m., Room 4

Briefing sessions for speakers, discussers and program officials by invitation.

Presiding: William J. Hedley, Chairman, Technical Program Committee

LOCAL SECTIONS CONFERENCE

Monday and Tuesday, June 13–14

9:30 a.m. **Room 7**

Representatives of Local Sections of ASCE in the area about the Convention city will convene for discussion of expanding activities of the Society at local level. This conference, which is primarily for invited delegates of selected Sections, will be open to all who may be interested in the activities and operational details of ASCE Local Sections.

TUESDAY MORNING JUNE 14

Engineering Mechanics Division

9:30 a.m. **Room 9**

Presiding: Douglas McHenry, Chairman, Executive Committee, Engineering Mechanics Division

9:30 **Open Channel Flow at Small Reynolds Numbers**

Edward Silberman, A.M. ASCE, Assoc. Prof., St. Anthony Falls Hydraulic Lab., Univ. of Minn., Minneapolis, Minn.

Lorenz G. Straub, M. ASCE, Director, St. Anthony Falls Hydraulic Lab., Univ. of Minn., Minneapolis, Minn.

Herbert C. Nelson, J.M. ASCE, Hydraulic Engineer, Kimberly-Clark Corp., Neenah, Wis.

10:10 **An Experimental Study of Boundary Layer Transition**

H. W. Bennett, Kimberly-Clark Corp., Neenah, Wis.

Charles A. Lee, M. ASCE, Hydraulic Engineer, Kimberly-Clark Corp., Neenah, Wis.

10:50 **Flow in Alluvial Channels**

James R. Barton, Asst. Prof. of Civil Engineering, Colorado A. & M. College, Fort Collins, Colo.

Pin-Nam Lin, Asst. Prof. of Civil Engineering, Colorado A. & M. College, Fort Collins, Colo.

11:30 **Acceleration of Bodies in Fluids and Some New Measurements of Virtual Mass**

T. E. Stelson, J.M. ASCE, Asst. Prof. of Civil Engineering, Carnegie Inst. of Technology, Pittsburgh, Pa.

F. T. Mavis, M. ASCE, Prof. and Head, Dept. of Civil Engineering, Carnegie Inst. of Technology, Pittsburgh, Pa.

Sanitary Engineering Division

9:30 a.m. **Room 3**

Presiding: B. A. Poole, Member, Executive Committee, Sanitary Engineering Division; Dwight F. Metzler, Chairman, Subcommittee on Public Health Activities.

The Impact of the Drought of 1952, 1953, 1954 on Water and Sewage Disposal Problems

9:30 **Introduction**

B. A. Poole, Member, Executive Committee, Sanitary Engineering Division.

9:35 **Meteorological Aspects Associated with Drought.**

Jerome Namias, U. S. Weather Bureau.

10:30 **The Recent Drought and Its Effect on Stream Flow**

Harry C. Bolon, A.M. ASCE, District Engineer, U.S. Geological Survey, Rolla, Mo.

11:15 **The Recent Drought and Its Effect on Ground Water**

Dr. Garrett A. Muilenburg, Asst. State Geologist of Missouri.

Construction and Structural Divisions—Joint Session

9:30 a.m. **Crystal Room**

Presiding: Leo H. Corning, Member, Executive Committee, Structural Division

The Arnold Engineering Development Center at Tullahoma, Tenn.

9:30 **The Purposes and Scope of AEDC**

S. R. Harris, Maj. Gen., U. S. Air Force; Commander, Arnold Engineering Development Center, Tullahoma, Tenn.

10:00 **Some Unusual Engineering Problems Encountered in the Design of Wind Tunnels**

W. K. Cook, M. ASCE, Project Engineer for AEDC, Sverdrup & Parcel, Inc., St. Louis, Mo.

10:40 **Structural Design of the World's Largest Supersonic Wind Tunnel**

Norbert Maurer, M. ASCE, Principal Engineer for Special Structures, Sverdrup & Parcel, Inc., St. Louis, Mo.

11:20 **The Fabrication and Erection of the Propulsion Wind Tunnel at AEDC**

J. O. Jackson, M. ASCE, Vice President, Engineering and Research, Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

Waterways Division

9:30 a.m. **Ivory Room**

Presiding: Charles M. Wellons, Member, Executive Committee, Waterways Division

9:30 **Accidents at Navigation Locks**

Ralph L. Bloor, M. ASCE, Chief, Structures Branch, Office, Chief of Engineers, Dept. of the Army, Washington, D.C.

George E. Oliver, A.M. ASCE, Engineer, Ohio River Div., Corps of Engineers, Cincinnati, Ohio.

10:10 **Flood Control on the Middle Mississippi River**

Walter F. Lawlor, M. ASCE, Chief, Engineering Div., St. Louis Dist., Corps of Engineers, St. Louis, Mo.

10:50 **Missouri River Basin Plan in Operation**

Wendell Johnson, M. ASCE, Chief, Engineering Div., Missouri River Div., Corps of Engineers, Omaha, Nebr.

11:30 **Great Lakes Water Levels**

Edwin W. Nelson, Chief Technical Asst., North Central Div., Corps of Engineers, Chicago, Ill.

WATERWAYS, HYDRAULICS, SOIL MECHANICS LUNCHEON

Tuesday, June 14

12:15 p.m. **Gold Room**

Speaker: John R. Hardin, M. ASCE, Brig. Gen., U. S. Army; President, Mississippi River Commission, and Div. Engineer, Lower Mississippi Valley Div., Corps of Engineers, Vicksburg, Miss.

Subject: The Problem of Control of Old River

Presiding: Clarence C. Burger, Chairman, Executive Committee, Waterways Division.

All Members, guests and friends of ASCE are cordially invited.

Per plate $3.50 Students $2.50

Sanitary Engineering Division

2:00 p.m. **Room 3**

Presiding: E. E. Bloss, M. ASCE, Consulting Engineer, St. Louis, Mo. S. W. Jens, M. ASCE, Consulting Engineer, St. Louis, Mo.

Theme: The Impact of the Drought of 1952, 1953, 1954 on Water and Sewage Disposal Problems

2:00 **The Impact of the 1952, 1953, 1954 Drought on Water Supply and Sewage Disposal Problems in Kansas**

Dwight F. Metzler, M. ASCE, Chief Engineer and Director, Kansas State Board of Health, Lawrence, Kans.

3:00 **The Effect of Air Conditioning on Distribution and Pumping Systems**

C. Kelsey Mathews, M. ASCE, Principal Engineer, Burns & McDonnell, Kansas City, Mo.

4:00 **The Effect of Air Conditioning on Supply and Treatment Facilities**

E. E. Bolls, Jr., A.M. ASCE, Consulting Engineer, Black & Veatch, Kansas City, Mo.

Structural Division

2:15 p.m. **Crystal Room**

Presiding: Richard R. Tipton, Chairman, Committee on Session Programs, Structural Division

2:15 **Impact in Railroad Bridges**

E. J. Ruble, M. ASCE, Research Engineer of Structures, Association of American Railroads, Chicago, Ill.

3:00 **Tightening High-Strength Bolts**

F. P. Drew, A.M. ASCE, Asst. Research Engineer of Structures, Association of American Railroads, Chicago, Ill.

3:45 **Investigation of Floor Beam Hangers in Railroad Trusses**

C. H. Sandberg, M. ASCE, Asst. Bridge Engineer, Atchison, Topeka & Santa Fe Railway System, Chicago, Ill.

Waterways, Hydraulics, and Soil Mechanics Divisions—Joint Session

2:00 p.m. **Ivory Room**

Presiding: Charles M. Wellons, Member, Executive Committee, Waterways Division

Symposium—Old River Diversion Control

2:15 **Hydraulic Requirements for a Solution**

E. A. Graves, A.M. ASCE, Chief, Special Studies Section, Engineering Div., Mississippi River Commission, Corp of Engineers, Vicksburg, Miss.

3:00 **Use of Models in Design of Old River Control Structures**

T. E. Murphy, M. ASCE, Chief, Structures Section, Hydrodynamics Branch, Hydraulics Div., Waterways Experiment Station, Corps of Engineers, Vicksburg, Miss.

3:45 **Investigation and Foundation Design**

W. J. Turnbull, M. ASCE, Chief, Soils Div., Waterways Experiment Station, Corps of Engineers, Vicksburg, Miss.

W. G. Shockley, A.M. ASCE, Chief, Embankment and Foundation Branch, Soil Div., Waterways Experiment Station, Corps of Engineers, Vicksburg, Miss.

4:30 **Structures for Control of Old River**

Norman R. Moore, M. ASCE, Chief, Engineering Div., Mississippi River Commission and Lower Mississippi Valley Div., Corps of Engineers, Vicksburg, Miss.

WEDNESDAY MORNING, JUNE 15

Welcome Session

9:30 a.m. **Ivory Room**

Presiding: Clarence H. Ax, President, St. Louis Section

Welcome by St. Louis Industry

A. P. KAUFMANN, President, Chamber of Commerce of Metropolitan St. Louis, Mo.

Response and Address

WILLIAM R. GLIDDEN, President, ASCE

General Session

10:00 a.m. **Ivory Room**

Sponsored by Committee on Conditions of Practice

Presiding: Mason G. Lockwood, Chairman, Vice President, ASCE

Problems of Engineering Education

10:00 **Engineering Education Since the War**

WESTON S. EVANS, M. ASCE, Chairman, ASCE Committee on Engineering Education; Prof. and Head, Civil Engineering, Univ. of Maine, Orono, Me.

10:20 **The Paradox of Professionalism in Engineering Education**

JOHN B. WILBUR, M. ASCE, Member of ASCE Task Committee on Engineering Education, Head, Dept. of Civil and Sanitary Engineering, Mass. Inst. of Tech., Cambridge, Mass.

10:40 **Engineering Education—An Appraisal**

ADOLPH J. ACKERMAN, M. ASCE, Chairman, ASCE Task Committee on Engineering Education, Consulting Engineer, Madison, Wis.

11:10 **Discussion**

ADOLPH J. ACKERMAN, presiding.

MEMBERSHIP LUNCHEON

Wednesday, June 15

12:15 p.m. **Gold Room**

Speaker: Honorable RAYMOND R. TUCKER, Mayor, City of St. Louis; formerly Head, Dept. of Mechanical Engineering, Washington University, St. Louis, Mo.

Subject: The Engineer in Public Life

Presiding: WILLIAM R. GLIDDEN, President, ASCE

All members, their ladies and guests and friends of ASCE are cordially invited to attend.

Per plate $3.75. Students $2.75.

WEDNESDAY AFTERNOON JUNE 15

General Session

2:15 p.m. **Ivory Room**

Panel Discussion of Report of Task Force on Water Resources and Power of Hoover Commission

Presiding: Louis R. Howson, Vice President, ASCE

2:15 **Scope of the Task Force Work, Its Organization and General Conclusions**

BEN MOREELL, Hon. M. ASCE, Adm., U. S. Navy (Retired); Chairman, Task Force on Water Resources and Power; President, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

2:35 **The Work and Conclusions of the Task Group on Power Generation and Distribution**

JOHN JIRGAL, Chairman of Task Group A; Specialist in Utility Economics and Finance, Chicago, Ill.

2:55 **The Work and Conclusions of the Task Group on Reclamation and Water Supply**

LESLIE A. MILLER, Chairman of Task Group B; former Governor of Wyoming; Chairman of Task Force on Natural Resources of first Hoover Commission, Cheyenne, Wyo.

3:15 **The Work and Conclusions of the Task Group on Flood Control**

W. W. HORNER, M. ASCE, Chairman of Task Group C; Consulting Engineer, Horner & Shifrin, St. Louis, Mo.

3:35 **The Work and Conclusions of the Task Group on Improvements to Navigation**

CAREY H. BROWN, M. ASCE, Chairman of Task Group D; Colonel, U. S. Army (Retired); former Manager, Engineering and Manufacturing Services, Kodak Part Works, Eastman Kodak Co., Rochester, N.Y.

3:55 **Implementation of the Hoover Commission's Recommendations to Congress**

Adm. BEN MOREELL, Hon. M. ASCE

4:15 **Discussion**

ENTERTAINMENT AVAILABLE

Wednesday Evening, June 15

Baseball: 8:00 p.m.

Cardinals vs. Pirates, Busch Stadium. Admission $1.85 per person.

Municipal Opera: 8:30 p.m.

"Brigadoon," musical fantasy under the stars. Admission $2.50 per person.

Transportation available direct from hotel to each location by special buses and taxicabs.

Tickets available in specially reserved sections until 6:00 p.m., Tuesday, June 14.

THURSDAY MORNING JUNE 16

Conditions of Practice

9:30 a.m. **Room 9**

Presiding: Mason G. Lockwood, Zone IV, Vice President, ASCE

Topic: Impact of Modern Business on Engineering Practice

9:30 **Competitive Bidding**

RAYMOND A. HILL, M. ASCE, Consulting Engineer, Leeds, Hill and Jewett, Los Angeles, Calif., and Chairman ASCE Committee on Professional Practice

10:00 **Advertising by Professional Engineers**

HERBERT C. GEE, M. ASCE, Consulting Engineer, Gee and Jenson, West Palm Beach, Fla., and Member ASCE Committee on Professional Practice

10:30 **Discussion**

Highway Division

9:30 a.m. **Ivory Room**

Presiding: Emmett H. Karrer, Vice Chairman, Executive Committee, Highway Division

9:30 **Effective Use of Consulting Engineers in the Expanded Highway Program**

REX M. WHITTON, M. ASCE, Chief Engineer, Missouri State Highway Commission, Jefferson City, Mo.

10:15 **Locating Expressways in the St. Louis Urban Area**

MYER ABLEMAN, Urban Engineer, Missouri State Highway Commission, St. Louis, Mo.

11:00 **Design for Interstate Highways**

JOSEPH BARNETT, M. ASCE, Chief,

Urban Highway Branch, U. S. Bureau of Public Roads, Washington, D.C.

City Planning Division

9:30 a.m. **Room 7**

Presiding: Harry W. Alexander, Chairman, Committee on Session Programs, City Planning Division

9:30 **Water Supply and Sewage System Planning for Greater Karachi**

Carroll V. Hill, Carroll V. Hill & Associates, Dayton, Ohio

Vance C. Lischer, M. ASCE, Partner, Horner and Shifrin, St. Louis, Mo.

Power Division

9:30 a.m. **Room 8**

Presiding: G. J. Vencill, Member, Executive Committee, Power Division

9:30 **McNary Dam—Coordination of Project Design and Construction**

Otto R. Lunn, Chief of Design Branch, Walla Walla District, Corps of Engineers.

10:30 **McNary Dam—Project Construction**

S. G. Neff, Chief of Construction Division, North Pacific Division Office, Corps of Engineers.

Structural Division

9:30 a.m. **Crystal Room**

Presiding: Warren Raeder, Member, Executive Committee, Structural Division

9:30 **Design of a Suspension Bridge for Aerodynamic Stability**

George S. Vincent, M. ASCE, Principal Highway Bridge Engineer, Physical Research Branch, U. S. Bureau of Public Roads, Washington, D.C.

10:10 **Sequence Summation Factors**

Adrian Pauw, A.M. ASCE, Assoc. Prof. of Civil Engineering, Univ. of Missouri, Columbia, Mo.

10:50 **Structural Features of St. Louis Airport Building**

William C. E. Becker, M. ASCE, Consulting Engineer, St. Louis, Mo.

11:30 **Continuous Arches on Elastic Piers**

James Michalos, M. ASCE, Professor and Chairman, Dept. of Civil Engineering, N. Y. Univ., New York, N.Y.

Darrel D. Girton, J.M. ASCE, Engineer, Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.

HIGHWAY DIVISION LUNCHEON

Thursday, June 16

12:15 p.m. **Gold Room**

Speaker: Karl Richards, Secretary, Highway Policy Committee, Automobile Manufacturers Assoc., Detroit, Mich.

Subject: Highways of the Future

Presiding: Rex M. Whitton, M. ASCE, Chief Engineer, Missouri State Highway Commission, Jefferson City, Mo.

All members, guests and friends of ASCE are cordially invited to attend.

Per plate $3.75. Students $2.75

THURSDAY AFTERNOON JUNE 16

Highway Division

2:15 p.m. **Ivory Room**

Presiding: Harmer E. Davis, Member, Executive Committee, Highway Division

2:15 **An Analysis of Five Years of Traffic Accidents on Missouri State Highways**

Leon W. Corder, Traffic Engineer, Missouri State Highway Dept., Jefferson City, Mo.

3:00 **Toll Roads—Their Place in the Expanded Highway Program**

T. J. Cambern, M. ASCE, Consulting Engineer, Howard, Needles, Tammen and Bergendoff, Kansas City, Mo.

3:45 **Sector Analysis of Concrete Pavements**

Bengt F. Friberg, A.M. ASCE, Consulting Engineer, St. Louis, Mo.

Sanitary Engineering Division

2:00 p.m. **Room 3**

Presiding: Ralph E. Fuhrman, Chairman, Executive Committee, Sanitary Engineering Division; Vance C. Lischer, Member, Program and Publications Committee, Sanitary Engineering Division

Sewage Pumping

2:00 **Sewage Pumping**

C. W. Klassen, Chief Sanitary Engineer, Illinois Dept. of Public Health, Springfield, Ill.

W. H. Jollie, A.M. ASCE, Sanitary Engineer, Illinois Dept. of Public Health

3:00 **Sewage Pumping**

H. H. Benjes, M. ASCE, Consulting Engineer, Black & Veatch, Kansas City, Mo.

4:00 **Factors to Consider in Sewage Pumping Station Design**

Perry Clifford Sharp, A.M. ASCE, Consulting Engineer, Haskins, Riddle & Sharp, Kansas City, Mo.

Hydraulics Division

2:15 p.m. **Crystal Room**

Presiding: Wallace M. Lansford, Member, Executive Committee, Hydraulics Division

Program by Committee on Floods

2:15 **Effects of Floods on Power Plants**

E. A. Rudolph, Mechanical Engineering Supt., Union Electric Co., of Missouri, St. Louis, Mo.

3:00 **The Effects of the Flood of 1951 on Industries of the Kansas Cities**

Keith R. Barney, M. ASCE, U. S. District Engineer, Kansas City, Mo.

3:45 **Effect of Floods on Transportation**

William H. Hobbs, M. ASCE, Chief Engineer, Missouri Pacific Lines, St. Louis, Mo.

Soil Mechanics and Foundations Division

2:15 p.m. **Room 9**

Presiding: A. B. Cleaves, Chairman, Task Committee on the Influence of Geological Factors on Tunnel Construction, Soil Mechanics and Foundations Division

Influence of Geological Factors in Relationship to Tunnel Construction

2:15 **Geophysical Investigation of Portal Areas for Thos. J. Evans Tunnel, NE Extension, Pennsylvania Turnpike**

H. Leroy Scharon, Prof. of Geology, Washington Univ., St. Louis, Mo.

3:00 **Heavy Ground Loads in Tunnel Construction in Faulted Areas**

Carl Rankin, M. ASCE, Construction Engineer, San Diego, Calif.

3:45 **Geological Hindsight in Tunnel Construction**

E. B. Waggoner.

4:30 **How Geology Fits Into the Design of Tunnels**

A. B. Reeves, M. ASCE, Chief, Irrigation Operations Div., U. S. Bureau of Reclamation, Denver, Colo.

Power Division

2:00 p.m. **Room 8**

Presiding: G. J. Vencill, Member, Executive Committee, Power Division

2:15 **Steel Linings for Pressure Shafts in Solid Rock**

E. W. Vaughan, M. ASCE, Hydraulic Engineer, Canadian-Brazilian Services, Ltd., Toronto, Ont., Canada.

3:00 **Model Tests, Analytical Computation and Observation of an Arch Dam**

M. Rocha, J. Laginha Serafim, A.M. ASCE, A. F. da Silveira and J. M. Ressumeicos Neto, Laboratorio Nacional de Engenharia Civil, Lisbon, Portugal

Presented by Jerome Raphael, M. ASCE, Assoc. Prof., Univ. of California, Berkeley, Calif.

3:45 **Principles of Federal Hydroelectric Power Development**

William Whipple, Jr., M. ASCE, Colonel, Corps of Engineers, Civil Works Dept., Washington, D.C.

SHOWBOAT DINNER PARTY

Thursday, June 16

6:30 p.m. **Ivory Room**

Cocktails, Courtesy of the St. Louis Section

7:15 p.m. **Gold Room**

Informal Dress. Per plate $6.50. Following the dinner, Captain Billy Menke and his Goldenrod Showboat troupe will present *The Drunkard.*

FRIDAY MORNING

JUNE 17

Soil Mechanics and Foundations Division

9:30 a.m. **Room 9**

Presiding: Ralph B. Peck, Member, Executive Committee, Soil Mechanics and Foundations Division

9:30 **Soil Mechanics—Dynamic Specialty of Civil Engineering**

M. D. Morris, Eastern Representative, Soiltest, Inc., New York, N.Y.

10:00 **Engineering Properties of Loessal Soils**

W. A. Clevenger, A.M. ASCE, Materials Engineer, U. S. Bureau of Reclamation, Denver, Colo.

10:45 **Relief Well Installations in the St. Louis District**

Representative of U. S. Corps of Engineers

11:30 **Engineering Aspects of Drought Damage in the St. Louis Area**

H. M. Reitz, A.M. ASCE, Assoc. Prof., Civil Engineering, Washington University, St. Louis, Mo.

Power Division

9:30 a.m. **Room 8**

Presiding: G. J. Vencill, Member, Executive Committee, Power Division

9:30 **Investigation of Erosion and Deterioration of Keokuk Spillway with Recommendations for Repairs**

Elmer E. Schake, A.M. ASCE, Sverdrup & Parcel, St. Louis, Mo.

Ralph L. Shelton, A.M. ASCE, Structural Engineer, Union Electric Co. of Missouri, St. Louis, Mo.

10:15 **The High Siphon Circulating Water System for Meramec Power Plant; Design Considerations and Subsequent Performance**

Charles E. Buettner, A.M. ASCE, and Paul A. Pickel, Union Electric Co. of Missouri, St. Louis, Mo.

11:00 **Box Canyon Hydroelectric Project**

Richard D. Harza, A.M. ASCE, Harza Engineering Co., Chicago, Ill.

Hydraulics Division

9:30 a.m. **Room 2**

Session Sponsored by Division's Committee on Sedimentation

Presiding: Wallace M. Lansford, Member, Executive Committee, Hydraulics Division.

Design of Sediment-Carrying Canals in Erodible Materials

9:30 **Characteristics of Alluvial Channels**

Don C. Bondurant, A.M. ASCE, Missouri River Div., Corps of Engineers, Omaha, Nebr.

10:10 **Design of Stable Canals and Channels**

P. W. Terrell and W. M. Borland, A.M. ASCE, U. S. Bureau of Reclamation, Denver, Colo.

10:50 **Practical Regime Theory Design of Artificial Channels with Self-Adjustable Boundaries**

T. Blench, M. ASCE, Civil Engineering Dept., Univ. of Alberta, Edmonton, Alberta, Canada.

11:30 **The Application of Sediment-Transport Mechanics to Stable Channel Design**

Emmett M. Laursen, A.M. ASCE, Research Engineer, Institute of Hydraulic Research, Iowa City, Iowa.

Surveying and Mapping Division

9:30 a.m. **Room 7**

Presiding: Benjamin E. Beavin, Sr., Member, Executive Committee, Surveying and Mapping Division

9:30 **Some Aspects of Electronic Surveying in Offshore Areas**

G. A. Roussel, Vice President, Offshore Navigation, Inc., New Orleans, La.

10:10 **Charts for the United States Air Force**

Richard W. Philbrick, Col.; Commander, Aeronautical Chart and Information Center, St. Louis, Mo.

10:50 **Surveying Trends in the Civil Engineering Curricula**

Harry Rubey, M. ASCE, Chairman, Civil Engineering Dept., Univ. of Missouri, Columbia, Mo.

11:30 **The Use of Topographic Maps in Highway Location**

Claude P. Owens, Engineer of Surveys and Plans, Missouri State Highway Dept., Jefferson City, Mo.

Construction Division

9:30 a.m. **Crystal Room**

Session Sponsored by Division's Pipeline Committee

Presiding: E. V. Hunt, Chairman, Committee on Pipelines, Construction Division

9:30 **Stresses in Pressure Pipelines and Protective Casing Pipes**

Merlin G. Spangler, M. ASCE, Research Prof. of Civil Engineering, Iowa State College, Ames, Iowa.

10:00 **Discussion**

10:30 **Defense Pipelines in Spain**

John R. Perry, Rear Adm., U. S. Navy; Chief of Bureau of Yards

PIPELINE COMMITTEE LUNCHEON

Friday, June 17

Sponsored by the Construction Division's Pipeline Committee

12:15 p.m. **Ivory Room**

Speaker: N. E. Tanner, President, Trans-Canada Pipe Lines Ltd.

Subject: Trans-Canada's 2,200-Mile Gas Pipe Line

Presiding: Eldon V. Hunt, Chairman, Committee on Pipelines, Construction Division.

All members, guests and friends of ASCE are cordially invited.

Per Plate: $3.75. Students $2.75.

and Docks, CEC, USN, Washington, D.C.

11:15 Discussion

PLANNED TOURS

Lambert—St. Louis Municipal Airport

Tuesday, June 14, 6:30 p.m.

Special buses will leave from the 12th St. entrance of the Jefferson Hotel at 6:30 p.m. to take you to the New Airport Terminal Building at Lambert-St. Louis Municipal Airport. This building is substantially complete but has not been placed in service. It is notable for an original and unusual type of thin-shell dome construction in its roof.

$1.50 per person.

Aeronautical Chart and Information Center

Friday, June 17, 2:00 p.m.

Special buses will leave the 12th Street entrance of the Jefferson Hotel at 2:00 p.m., to visit the Aeronautical Chart and Information Center. This should prove most interesting to those attending the morning meeting of the Surveying and Mapping Division. It is here that all charts are prepared for the U.S. Air Force, using the most modern equipment and methods.

$0.75 per person.

Chain-of-Rocks Canal and Locks

Friday, June 17, 2:00 p.m.

Buses will leave the 12th Street entrance of the Jefferson Hotel at 2:00 p.m. They will cross the Mississippi River to the Illinois side to the recently completed locks, 1,200 ft long by 110 ft wide, and 600 ft long by 110 ft wide, near the lower end of the 8-mile navigation canal bypassing the Chain-of-Rocks reach of the Mississippi River. The tour will include an inspection of the new Granite City harbor of the Bi-State Development Agency. Return trip will include 5 miles along the canal, crossing of the river on the Chain-of-Rocks bridge, and a drive along the municipal waterworks plant, arriving at the Jefferson Hotel at 4:30.

$1.75 per person.

LADIES ENTERTAINMENT

Ladies Headquarters: Ladies' Lounge Room

The Ladies' headquarters will be the gathering place for all ladies attending the Convention. It will be open from 9:00 a.m. to 5:00 p.m. Monday through Friday. Coffee will be served each morning Tuesday through Friday from 9:00 to 9:30. Hostesses will be in attendance to assist visiting ladies in the enjoyment of the Convention. The theme of the Convention will be "Meet Me in St. Louis."

Tuesday, June 14

12:30 p.m. **"Meet Me at the Fair," luncheon**

In the Tiara Room of the Park Plaza Hotel, followed by a book review.

Per person $4.00

Wednesday, June 15

9:30 a.m. **"Old St. Louis"**

Tour of the Old Courthouse, Old Cathedral, Mississippi River Front, Missouri Botanical (Shaw's) Gardens, and other interesting and historical places. Buses will leave the Hotel Jefferson at 9:30 a.m. and will return before noon.

No charge.

12:15 p.m. **Welcome Luncheon**

Ivory Room, Hotel Jefferson

Per Plate $3.75

Thursday, June 16

9:30 a.m. **"Garden on the Missouri"**

Tour of the beautiful Joseph Desloge Gardens on the bluffs of the Missouri River, then to the Glen Echo Country Club for luncheon. Buses will be provided.

$4.00 per person including transportation.

Friday, June 17

9:30 a.m. **"Day in the Park"**

Tour of Forest Park, visiting the Lindbergh trophies in the Jefferson Memorial Building, the Jewel Box and the world-famous zoo, followed by luncheon at the Art Museum. Private cars will be provided for transportation.

Per person $1.50.

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained on the mezzanine of the Jefferson Hotel throughout the days of the Convention. Mail and messages will be held for members at the information desk.

CONVENTION OFFICE AND PRESS ROOM

East Room

For coordination of Convention operations, a business office will be maintained, and press facilities will be available throughout the days preceding and during the Convention.

HOTEL ACCOMMODATIONS

Headquarters for the St. Louis Convention will be the Jefferson Hotel, Twelfth Blvd. at Locust, in downtown St. Louis. Special arrangements have been made with this hotel to house many of those attending the Convention in the headquarters hotel, in the order that reservation requests are received.

Send your request as early as possible to assure the space you prefer. For your convenience, a special request form is provided on page 118 of this issue.

ST. LOUIS CONVENTION COMMITTEES

Brice R. Smith, *General Chairman*

General Convention Committee
Clarence H. Ax
Ernest W. Carlton
Carl J. Chappell
Wesley W. Horner
Lawrence P. Roth
Edwin E. Rippstein
R. Earl Salveter

Hotel and Registration
Joseph B. Brooks, *Co-Chairman*
Joseph W. Graves, Jr., *Co-Chairman*

Entertainment
Stifel W. Jens, *Chairman*

Excursions and Transportation
Robert A. Willis, *Chairman*

Exhibits
Eldred B. Murer, *Chairman*

Finance
Joseph A. Vollmar, Jr., *Chairman*

Ladies Activities
Mrs. William J. Hedley, *Co-Chairman*
Mrs. Brice R. Smith, *Co-Chairman*

Local Sections Conference
Bengt F. Friberg

Public Relations
Verner C. Hanna, *Chairman*

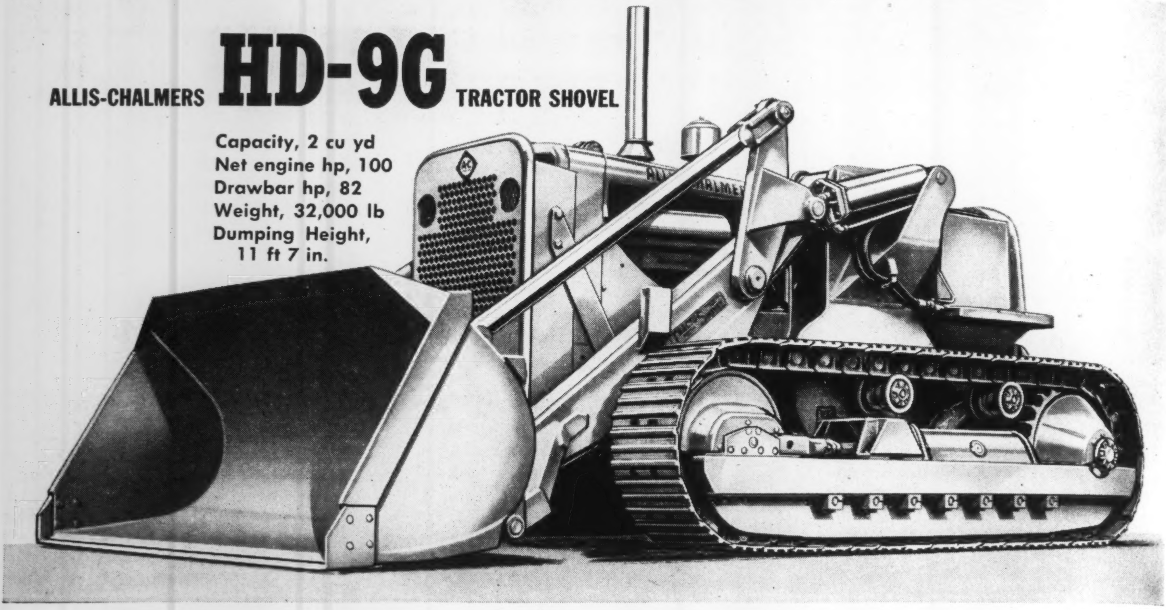
Reception
Lawrence B. Feagin, *Chairman*

Student Activities
Henry M. Reitz, *Chairman*

Technical Program
William J. Hedley, *Chairman*

ALLIS-CHALMERS **HD-9G** TRACTOR SHOVEL

Capacity, 2 cu yd
Net engine hp, 100
Drawbar hp, 82
Weight, 32,000 lb
Dumping Height,
11 ft 7 in.

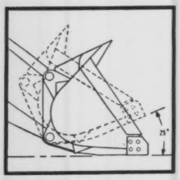


POPULAR 2-YD HD-9G TRACTOR SHOVEL NOW OFFERS

Higher Work Capacity

Design refinements in the Allis-Chalmers HD-9G now make it even more productive than ever. First, the net engine output has been increased to 100 hp, with 23,000 lb of push for extra crowding and digging ability, fast work cycles.

Streamlined bucket design now helps roll in large loads with less tractor effort. The back of the bucket has been brought forward and the sides extended to cut spillage, put more pay load where it's wanted. Cleaner dumping with the new bucket saves the operator time and effort shaking out loads.



A new addition to the wide variety of attachments available for the HD-9G Tractor Shovel is the Tip-Back bucket which allows the operator to roll the bucket back approximately 25° at ground level. Ideal for handling greater capacities of loose stockpiled materials, the Tip-Back bucket can be carried lower to the ground for greater stability . . . can load bulky objects easier.

New-type ceramic master clutch lining reduces lever pull, makes it easier for the operator to do more. The new HD-9G helps the operator do more in other ways, too — giving him full vision, fast and easy control, cleaner platform and more comfortable seat from which to work, and more working time with truck wheels, support rollers and idlers that need greasing only once every 1,000 hours.

Lower Operating Cost

Design improvements also add longer life to the HD-9G under all work conditions. Heavy box-section booms are 50 percent stronger, assuring proper alignment even working in the toughest materials. The low design of the new HD-9G combination stabilizer and cowl not only offers easy accessibility for maintenance and service, but contributes to maximum operator vision. New ceramic master clutch lining operates longer between adjustments, increases clutch life.

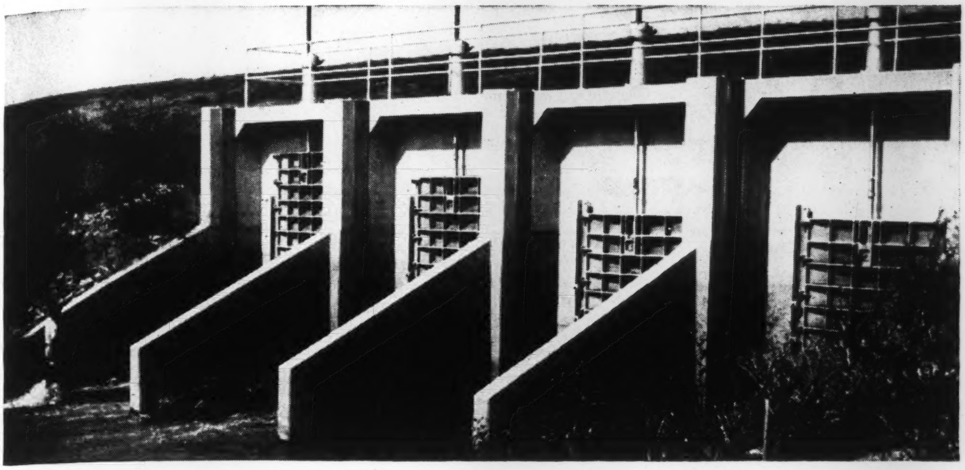
Hydraulic system provides new maintenance simplicity, safety of operation, as well as improved visibility. With new-style tank, there are few external fittings, greatly reducing possibility of outside leaks. Magnetic filters and suction-line screens protect the entire system from damaging grit. New, improved hydraulic pump is designed for long life as well as fast and accurate bucket action.

Heavy-duty truck wheels and idlers are available for particularly tough working conditions. One-piece, full-length main frame permits unit construction so that major assemblies can be removed without disturbing adjacent units, putting tractor back on the job in hours rather than days.

☆ ☆ ☆

See your Allis-Chalmers dealer for further information on what the HD-9G can do for you — or a demonstration right on your job.

ALLIS-CHALMERS
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.



Typical Armco Slide Gates

Armco Gates give you efficient, low-cost water control

There are more than 30 standard models of Armco Water Control Gates—and all are supplied in a choice of sizes. This means you can select the exact gate you need to solve problems of flood control, irrigation or water supply efficiently and economically.

When you choose Armco Gates, you get quick, easy operation, practical watertightness and long service life at *moderate cost.* Evidence of this is in the thousands of satisfied users of Armco Gates since 1911.

Of the various types of Armco Gates, two are particularly useful in flood control and other engineering projects. These are:

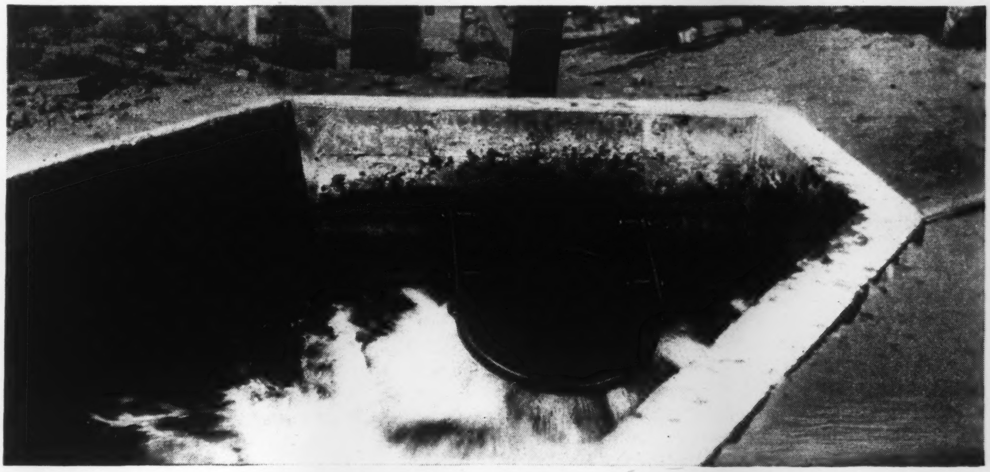
SLIDE GATES. ***Light or heavy duty; withstand face pressures up to 50 feet; rectangular or circular in sizes from 8 inches up to 96 inches, cast iron or structural steel.***

FLAP GATES. ***Will withstand face pressures up to 50 feet; circular openings from 4 to 120 inches; rectangular openings from 24 inches square to 72 by 44 inches; cast iron, cast steel or plate steel.***

Other types of Armco Gates include: Radial Gates, Roller Bearing Gates, and Meter Gates. These too are available in a wide size range. For more data on Armco Gates, write us, telling about your water control problem. Armco Drainage & Metal Products, Inc., 5355 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

Armco Water Control Gates

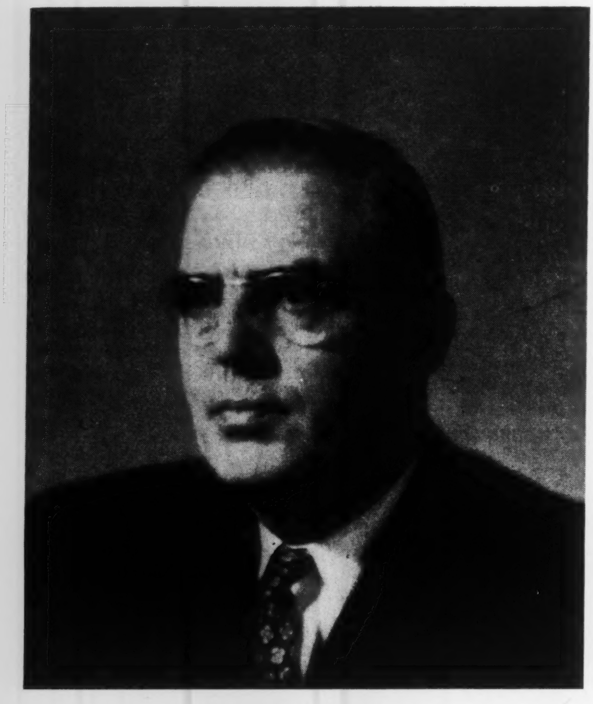
ARMCO ®



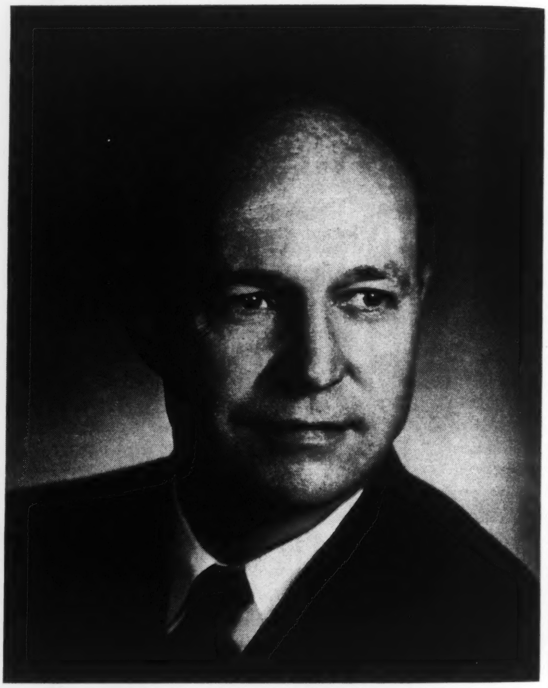
An Armco Flap Gate in Action

SOCIETY NEWS

Executive Secretary Carey Retires
Is Succeeded by William H. Wisely



WILLIAM N. CAREY
Secretary Emeritus



WILLIAM H. WISELY
Executive Secretary

William N. Carey, Executive Secretary of ASCE for the past ten years, has served the Society in many capacities since his first connection with it in 1916 when he became an Associate Member. For his outstanding work as Executive Secretary, the Board of Direction recently presented him with a special plaque usually reserved for retiring Presidents. The citation accompanying the plaque characterizes him as an "engineer of note, administrator of distinction, and a valiant engineer officer in two World Wars." It continues, "His service to the Society—on its committees, in contributions to its publications, in a term as Director, and in ten years as Executive Secretary—has been vigorous and loyal... Under his guidance the Society's Constitution was modernized and significantly amended. With characteristic foresight he launched a compelling program toward obtaining a new headquarters building. Recognizing the potential of group effort, he has been prominent in efforts to obtain national and international unity of the engineering profession."

William H. Wisely, who takes office as Executive Secretary of ASCE, became an Associate Member in 1936 and a Member in 1944. He was president of the Society's Central Illinois Section in 1941. A native of Coulterville, Ill., Mr. Wisely is a graduate of the University of Illinois, from which he holds two degrees. He has been an assistant engineer in the Illinois State Water Survey, assistant sanitary engineer in the Illinois Department of Public Health, and engineer-manager of the Urbana and Champaign Sanitary District. From 1944 until the first of this year, when he became Associate Secretary of ASCE, Mr. Wisely was executive secretary of the Federation of Sewage and Industrial Wastes Associations and editor of its journal, *Sewage and Industrial Wastes*. He is a special lecturer in civil engineering at the University of Illinois, and author and co-author of many technical papers. In 1943 Mr. Wisely received the Kenneth Allen Award of the Federation of Sewage Works Associations, and he has been on the Ohio River Valley Water Sanitation Commission.

Tribute to "Bill" Carey

Of the many tributes to William N. Carey that have appeared in Local Section publications since Mr. Carey announced his intention of retiring as Executive Secretary, the following editorial by Albert S. Fry published in the February issue of the "Tennessee Valley Engineer" well expresses the affection of members for the retiring Secretary and their appreciation of his many services to the Society:

William N. Carey, Executive Secretary of the American Society of Civil Engineers—that's his official title but somehow or other that always sounded stiff and formal and while appropriate to the office, not at all appropriate to the man himself. Just plain Bill Carey seems to fit better, so we are going to write a brief editorial about plain Bill.

Bill is retiring as Secretary of ASCE, a post he has held for the past ten years. Taking over from his predecessor, the late George T. Seabury, Bill Carey has guided the ship of ASCE oftentimes through turbulent waters but always forward and onward. During his tenure of office, many notable events have taken place in the history of ASCE and Bill Carey has had a prominent part in writing these pages. . .

As Chairman and later Secretary of the Society's Hydraulics Division, the writer has had numerous contacts with Bill Carey. In all of these, he has ever been most cooperative and helpful. When the Hydraulics Division proposed to hold a meeting of its own in Jackson, Mississippi, in 1950, the idea did not meet with ready official approval because of fancied possible detraction from Society meetings. Bill Carey was most helpful in overcoming these objections. In the many details connected with the planning, the publicity, and the meeting arrangements, he made every possible Society facility available to the end of making the meeting the grand success that it was.

The work of a Technical Division involves many contacts with the Secretary of the Society. In all of these pertaining to the Hydraulics Division, we have found Bill Carey ready and eager to assist in every way possible in solving the problems that come up. Other Technical Divisions have certainly had the same experience. This attitude on the part of the Secretary has greatly advanced the work of all the Technical Divisions.

When ASCE technical papers were piling up and a huge backlog was accumulating with dissatisfaction rampant throughout the Society, it was Bill Carey who stepped into the breach and came up with a solution for the situation. In a noteworthy report, he reviewed the problem and recommended our present system of Separates. With minor modifications, his plan was adopted with the result that ASCE publications are rolling off the presses and the backlog is a thing of the past.

What we have written about Bill Carey comes largely from our own experiences. Others will have had different experiences but when all of these are added up, the sum total is large and on the plus side in advancing the welfare of ASCE.

Bill Carey has made a notable and lasting contribution to ASCE during the ten years he has served as Secretary. The results of his management of ASCE's affairs will be evident for a long time to come.

In retiring as our Secretary, Bill Carey takes with him the best wishes of the thousands of members of our Society that he has served so well.

Kickbacks Condemned

***By ASCE Committee on Professional Practice** (Raymond A. Hill, Chairman; N. T. Veatch, Vice-Chairman; Karl R. Kennison, Herbert C. Gee, and Lloyd D. Knapp)*

There have been rumors to the effect that engineering firms which seek design and supervision work on some public projects, such as for state and toll roads, are faced with demands for—or they offer—cash or percentage fees to be paid to persons of "influence" to get the jobs, or else they are not employed. These rumors come from various sources, and they pertain to more than a few states. They are hard to prove, and no one comes to mind who recently has given definite evidence of the existence of demands or offers for such illegal payments.

John R. Snell, A.M. ASCE, head of civil and sanitary engineering at Michigan State College, in an article on ethics in the July 1954 *Consulting Engineer*, states: "There is a moral laxity among consulting engineers in policy-making positions that seriously undermines the long-standing confidence our profession has enjoyed." Of four basic problems facing the profession he says the most serious are lack of integrity and actual dishonest practices, summed up in his Item No. 1:

"1. Giving kickbacks, commissions, finder's fees, payment for influence, to assist in obtaining (or in payment for) engineering work."

Michael Baker, Jr., M. ASCE, referred to Dr. Snell's article in a letter to *Consulting Engineer* of September 1954, in which he said:

> "I, too, am sincerely ashamed of my fellow engineers and the depths to which they have stooped in lack of integrity and in actual dishonesty in an effort to acquire business. The practices of kickbacks, etc., which you mention, have become quite a prerequisite in some branches of engineering in recent years. Some firms have given in to this practice with the feeling that it was self-defense, and in order to maintain the status quo and volume of business necessary to maintain their staff, have agreed to go along on such practices. . . . As a matter of fact, these practices have brought down an odor upon the profession to such a degree that many politicians seem much surprised when an honest firm comes along and doesn't first offer a 'deal' and has to be approached."

The Code of Ethics of the American Society of Civil Engineers states that it shall be considered unprofessional and inconsistent with honorable and dignified bearing for a member:

"9. To use undue influence or offer commissions or otherwise to solicit professional work improperly, directly or indirectly."

The engineer who gets a telephone call from a "friend," meets a friend of a friend in a hotel room, agrees to pay him a lump sum or percent of his engineering fees for his influence in getting the job, is doing wrong to himself, the profession, and the public. Such payments are illegal, unethical, and bound to hurt everybody concerned.

It is difficult to prevent such a practice when it is so difficult to detect it and to call the guilty parties to book. Very few engineers are guilty of it. The great majority, no doubt, would welcome a method whereby, in an engineering contract, they can testify that they have paid no improper fee for obtaining the work.

If these rumors are to any extent true with respect to the present construction and engineering program prevailing in the United States today, there will be trouble when the big government road program of over one hundred billion dollars is split up among the states and placed under way.

The Armed Services for many years have included a paragraph in their engineering contracts concerning kickback fees, somewhat as follows:

"ARTICLE 11. *Covenant Against Contingent Fees.* The Contractor (that is, the engineer) warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, except bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration the full amount of such commission, percentage, brokerage, or contingent fee."

If states, counties and municipalities will include such a paragraph or a stronger one in their engineering contracts, this evil practice may be halted or wiped out. Having to go on record that he has not paid a kickback or commission will make any engineer think twice before he submits to the hateful practice.

EJC Lists Key Engineers For Emergency Reference

Engineers Joint Council is assembling a "Finder's List" of key members of the profession throughout the nation who would assist in locating engineering talent needed in time of national emergency. The work is being done in cooperation with the National Science Foundation, Washington, D.C., which Congress directed to establish a National Register of Scientific and Technical Personnel. Engineers Joint Council has undertaken to maintain the engineering phase on a current basis.

Some 8,000 of an anticipated 20,000 leaders in all branches of engineering have already been listed. These are men of recognized standing whose experience or present positions enable them to know where engineering help may be found. Through them, in time of emergency requiring immediate location of experts in particular fields, the government will be able to contact the needed personnel.

Engineers Joint Council is a federation of ten major national organizations with a total membership of 196,000. However, the rest of the approximately 50,000 engineers of the nation are equally represented on the "Finder's List."

Several major scientific organizations have undertaken the registration of scientists, with the expected total approaching 200,000. This section of the Register will not be limited to a "Finder's List" but has as its objective the inclusion of all qualified scientists. The records, both as to engineers and scientists, will be maintained by the individual organizations with copies in the hands of the Foundation.

Location of Engineering Societies Center Building Not Settled

The best place for the proposed new Engineering Societies Center Building is still under study. Four cities are under active consideration, namely, Chicago, Philadelphia, Pittsburgh and New York. The following steps toward a decision have been made. United Engineering Trustees (UET) has recommended New York; the Committee of Five Presidents recommends Pittsburgh; and the Board of AIEE voted for a two-story building on the Schenley Park site in Pittsburgh at its St. Petersburg, Fla., meeting April 13, 1955, and recommended similar action by the Boards of the other Societies.

Chicago

In Chicago the favored location is a free site of five acres on the campus of the Illinois Institute of Technology. This site is large enough to accommodate a building of 200,000 sq ft and of not more than two stories. At this location a plan to coordinate the Engineering Societies Library (ESL) with the Crerar Library is possible, a plan which would be particularly advantageous if the Crerar Library makes a contemplated move to a nearby site on the same campus.

Philadelphia

In Philadelphia the favored proposal is a $6^1/_2$-acre free site on the northern border of a warehouse district and adjacent to the campuses of the University of Pennsylvania and Drexel Institute of Technology. Here a low building also could be built, and parking facilities would be adequate. The two educational institutions have indicated their desire to coordinate the operation of their own libraries with ESL or to consolidate them. Library service to members at less cost than now could result. The Philadelphia committee has stated that it "will neutralize the financial offer of any other city by donating in addition (to the free site) one million dollars, or more as may be necessary, as a cash contribution to the building of the new headquarters."

Pittsburgh

In Pittsburgh two sites are under consideration. Since December of 1953, Pittsburgh industrialists have had $1,300,000 in trust toward the construction of the Engineering Societies Center Building, and the city has offered a free site in Schenley Park, where Carnegie Institute of Technology, Carnegie Institute and Library, Mellon Institute, and the University of Pittsburgh would be close neighbors. It is now a distinctly cultural center. Close cooperation of ESL with Carnegie Library directly across the street has been assured. The Schenley Park site is adequate for a low building.

A site in downtown Pittsburgh's new Gateway Center is also offered. This 30,000-sq ft site would be purchased from a fund of $1,500,000 made available from the trust mentioned above if it were selected, and this site would require construction of a multi-story building, seven or eight stories high, and at a greater first cost and operating cost than a low building. Here parking facilities are available nearby, and the leading hotels are close at hand.

As an added incentive to locating the Engineering Societies Center Building in Pittsburgh the Mellon family has indicated its feeling of continuing responsibility to the Societies by pledging a grant of $500,000 to them to be used for scientific research during the first five years following the establishment of their headquarters in Pittsburgh.

New York

A site in New York's Columbus Circle area has been offered, its purchase price being pledged by a New York industrial group. It is at 60th Street and Columbus Avenue and is part of a proposed slum-clearance project known as Lincoln Square. The site is just north of the property on which the new Coliseum is being erected. The Committee of Five Presidents does not favor this site but has considered other sites in the neighborhood of Grand Central station close to the major hotels.

In New York a multi-story building would be required; no site which seems acceptable for a low building has been found. Parking facilities could not be provided in this area.

While no little emotional reaction exists favorable to remaining in New York, a suitable New York site has not been developed as yet and a financing plan as favorable as those in the other three cities has not been put forward. It is still not certain that the present value of the Engineering Societies Headquarters building exclusive of the land, which was constructed following a gift by Andrew Carnegie for the building alone, could be used for construction in another city. The building is presently valued at about $500,000. A ruling is yet to come from the Supreme Court of the State of New York on this question.

A recent editorial in the *New York Herald-Tribune* stated in part "Pittsburgh, Chicago and Philadelphia are actively trying to lure the engineers away. Although this situation has been developing for a couple of years, no one has succeeded in presenting an acceptable counter-inducement. Must it be assumed, then, that Pittsburgh, Chicago and Philadelphia are more alert and aggressive than New York?"

Governor Averell Harriman in a telegram, sent April 11 to W. J. Barrett, chairman of UET, said that he is certain that "the efforts being made by Mayor Wagner in association with New York business leaders will be successful in locating new offices and obtaining the financial assistance necessary to acquire them."

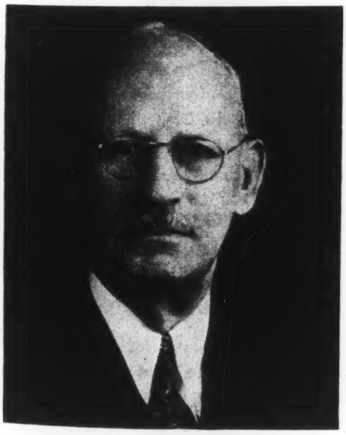
The boards of directors of ASCE, AIME, ASME, AIEE, and AIChE are giving active continuing consideration to finding the location best qualified to serve as the combined headquarters of these five Societies, and one which they can afford. It is heartening to know that so many cities want the engineering headquarters in their midst.

Society Loses Three Honorary Members

A. P. Greensfelder

Albert Preston Greensfelder, eminent engineer and contractor and Honorary Member of the Society, died in St. Louis, Mo., on April 18. He was 75. A native of St. Louis and a graduate of Washington University, class of 1901, Mr. Greensfelder started his career as principal assistant engineer for the Terminal Association of St. Louis on the design and construction of railroad terminal facilities in the area. From 1906 on he was associated with the Fruin-Colnon Contracting Company, which he served as president from 1927 to 1940. Since the latter date he had been chairman of the board and consultant to the company. His firm built many important St. Louis projects.

Mr. Greensfelder became a Junior Member of the Society in 1904, Associate Member in 1906, and Member in 1926. He was elected to honorary membership in 1946. His services to the Society have included the chairmanship of the Executive Committee of the Construction Division. His lifelong interest in construction led him in 1939 to establish the Construction Engineering Prize, given annually for the best construction paper appearing in CIVIL ENGINEERING. His professional affiliations included a term as president of the Associated General Contractors of America. Mr. Greensfelder was also a planning authority and had served on numerous local planning boards and as delegate to several international building and planning conferences.



A. P. Greensfelder

Harvey S. Mudd

Harvey Seeley Mudd, mining engineer and civic leader, died at his home in Beverly Hills, Calif., on April 12 at the age of 66. Though Mr. Mudd was not a civil engineer, he was elected an Honorary Member of ASCE in 1952 in keeping with the Society's Centennial Celebration program of honoring engineers prominent in other branches of the profession. Mr. Mudd's major business interest was the Cyprus Mines Corporation, a Mediterranean copper concern, of which he was president and managing director.

Harvey S. Mudd

Mr. Mudd was a director and vice-president of the AIME for many years, and in 1945 served as its president. In 1929, in cooperation with other members of his family, he established the Seeley W. Mudd Memorial Fund, the income of which goes to the AIME for researches, publications, or other projects that will advance the science and arts of metallurgy. He was a founder of the Southern California Symphony Association and president of it for twelve years and on the board of governors of the Los Angeles Museum of History, Science, and Art. In 1936 he received an annual award given by the City of Los Angeles to the citizen contributing "the most valuable and unselfish service to the community."

John C. Page

John Chatfield Page, Honorary Member of the Society and Commissioner of the Bureau of Reclamation from 1937 to 1943, died in Denver, Colo., on March 23. He was 68. Mr. Page had completed thirty-eight years in reclamation work in the West when he retired in 1947 because of ill health. He joined the Reclamation Service, as it was then known, on work on canals in western Colorado in 1909, following graduation from the University of Nebraska and graduate work in hydraulics at Cornell University. Later he was project superintendent on the Grand Valley Project near Grand Junction, Colo. When construction started on Hoover Dam in 1930, Mr. Page was appointed office engineer for the project and remained there until its completion. He was then called to the Bureau's Washington Office to head the Engineering Division and to aid the Commissioner, becoming Acting Commissioner in 1936. While Commissioner he directed the construction of many important projects including Grand Coulee and Marshall Ford dams. From 1943 until his retirement, he served the Bureau as a consultant.

A member of ASCE since 1936, Mr. Page was made an Honorary Member in 1953. He received the Department of the Interior Gold Medal for Distinguished Service in 1950. He had been a member of the Water Resources Committee of the National Resources Committee, and in 1936 was a member of President Roosevelt's Great Plains Drought Committee.

John C. Page

San Francisco Section to Be Host to Hydraulics Division

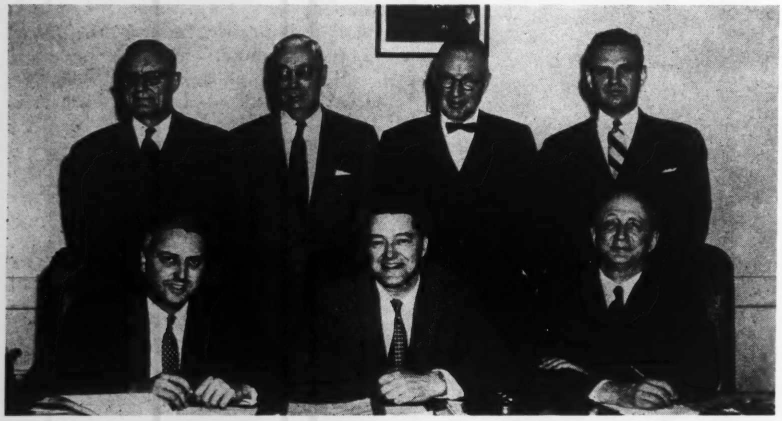
This year the annual meeting of the Hydraulics Division will be held on the Berkeley campus of the University of California, August 24, 25, and 26. The San Francisco Section will be the official host for the meeting. Headquarters for the meeting will be the Hotel Durant, just off the campus. The local committee is planning an inexpensive meeting in an informal atmosphere. No evening functions are scheduled so that individuals and families may follow their own whims in exploring San Francisco and the adjacent Bay Area. Some housing will be available on the campus, and the remainder will be provided at the Hotel Durant and other local hotels and motels. Descriptions and prices of accommodations may be obtained from the general chairman of the meeting.

An excellent technical program is being prepared, the details of which will be given in the July issue of CIVIL ENGINEERING. There will be five half-day sessions, with one half-day devoted to an inspection of the hydraulic facilities of the University of California both on campus and at the new Engineering Field Station in Richmond.

Cosmopolitan San Francisco, across the famous Bay Bridge from the meeting, will provide unlimited opportunities for the sightseer. Across the Golden Gate bridge he will find beautiful redwood groves at Muir Woods National Monument, and from Mt. Tamalpais he may look down on much of the Bay Area and some of the spectacular coastline south of the Golden Gate. South of San Francisco is the Skyline Drive "down the Peninsula" leading to beaches, redwood groves, and delightful residential areas. The Stanford University campus can be included in any sightseeing trip in this direction. Arrangements are being made for engineers to visit (before and after the meeting) the new Feather River hydro developments of the Pacific Gas and Electric Company and the Cherry Valley dam of the City of San Francisco under construction in the Sierra.

The local committee is composed of Revoe C. Briggs, Wesley F. Getts, E. Neil Murphy, David K. Todd, and John K. Vennard, general chairman.

U.S. Civil Service Group Seeks to Improve Federal Service



Photographed at meeting of Civil Service Commission and its Advisory Committee on Engineers are (seated, left to right) John W. Macy, Jr., executive director of the Civil Service Commission; Philip Young, CSC chairman; and Joseph H. Ehlers, ASCE Field Representative and chairman of the Advisory Committee on Engineers. Standing, in same order, are Blake R. Van Leer, president, Georgia Institute of Technology; Leslie N. McClellan, M. ASCE, chief engineer, U. S. Bureau of Reclamation; Ezra B. Whitman Past-President of ASCE and Baltimore consultant; and Henry A. Sawchuk, A.M. ASCE, CSC staff reprentative. Other committee members not shown in the photo are N. W. Dougherty, M. ASCE, dean of engineering at the University of Tennessee and president of the American Society for Engineering Education, and James D. Forrester, dean of the University of Idaho School of Mines. See page 80, for story of meeting.

ASCE MEMBERSHIP AS OF APRIL 8, 1955

Members	8,874
Associate Members	11,391
Junior Members	17,843
Affiliates	70
Honorary Members	41
Total	38,219
(April 9, 1954	37,250)

Coming Events

Central Illinois—Joint dinner meeting with the University of Illinois Student Chapter, Loyalty Hall, Champaign, May 19, at 6:30 p.m.

Metropolitan—Meeting in the Third Floor Auditorium of the Engineering Societies Building, 33 West 39th Street, May 18, at 7 p.m.

Mid-South—Picnic meeting of the Little Rock Branch and the Little Rock Engineers Club at Pavillion No. 2 of Boyle Park, Little Rock, June 4.

Mohawk-Hudson—Dinner meeting in Kingston, N.Y., May 14. Reservations should be sent to Gordon Ayer, Engineer in Charge, U.S.G.S., Ellenville District Office, Ellenville, N.Y.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday at 12 noon.

San Francisco—Wednesday luncheons at the Engineers Club. Tickets at the desk at $1.50 per person.

Wisconsin—Meeting in Milwaukee on May 26 devoted to "Thin Shell Design."

Scheduled ASCE Conventions

ST. LOUIS CONVENTION
St. Louis, Mo.
Jefferson Hotel
June 13–17, 1955

NEW YORK CONVENTION
New York, N.Y.
Hotel Statler
October 24–28, 1955

DALLAS CONVENTION
Dallas, Tex.
Hotel Baker
February 13–17, 1956

NOTES FROM THE LOCAL SECTIONS

(Copy for these columms must be received by the tenth of the month preceding date of publication.)

Junior Members of the **Arizona Section** at Johannessen and Girand are trying to organize luncheon or similar meetings. They will be glad to have helpful suggestions from other Junior Members.

Design and construction of welded structures was the subject of discussion at the **Cincinnati Section's** March meeting, with James G. Clark, professor of civil engineering at the University of Illinois, the featured speaker.

In a talk entitled "Bridging Mackinac on Prepakt Concrete," given at the March 18 meeting of the **Cleveland Section,** John King, chief engineer for the Prepakt Concrete Company, described the construction of the cable anchorages for the famous Mackinac Straits Bridge. Slides showed boat loads of aggregate ($^{3}/_{4}$ to 5 in.) being unloaded into the forms directly from the boat, in 10,000 to 15,000-ton lots, while the mixing plant prepared the "intrusion adnux" or grout which was pumped into the aggregate. Between 4,000 and 5,000 cu yd of concrete were poured by this method in one day, working around the clock. All material was placed under water.

The **Colorado Section** continues to "break 100" at its monthly meetings. At the February meeting Earl Moseley, secretary-manager of the Denver Water Board, outlined the city's water supply situation. Stressing the complex engineering planning implicit in all sound city growth, Mr. Mosely reminded his hearers that cities have atrophied and died for want of water. "Modern cities can survive with the engineering skills available," he said, "but not without large public works for multiple-purpose storage of floods and intricate diversion and distribution plans." Other recent speakers have been Milo Ketchum, Jr., who discussed thin-shell concrete construction in Mexico, and Paul J. Foehl, whose subject was "Relative Economy of Various Kinds of Steel Structures."

Problems facing the contractors who will construct the dams and locks required for the St. Lawrence Seaway Project were discussed at a meeting of the **Dayton Section** on March 21. Harvey Goodell, chief engineer of the Maxon Construction Company, was the featured speaker.

Heard at the **Duluth Section's** March meeting was W. R. Seestrom, manager of the Western Division of the Aero Service Corporation at Duluth, whose subject was the application of photogrammetry to aerial photography. Early this year each member of the Section's **Iron Range Subsection** agreed to be responsible for one of the monthly programs. Vice-President Dick Heil is program coordinator. R. V. Banks, office engineer for the Anaconda Company at the Erie Mining Company's taconite plant construction at Aurora, entertained at the Subsection's February meeting with a talk entitled "Engineering, Ancient and Modern."

Planning and allied problems facing the Atlanta area were analyzed and partial solutions suggested in the leading talk at the **Georgia Section's** April meeting—given by Robert H. White, chairman of the Atlanta Metropolitan Planning Commission and president of the Southern Wood Preserving Company. Mr. White was introduced by Col. Moses Cox, engineer-executive of the Joint Bond Committee and a past-president of the Section. Colonel Cox was being congratulated on his recent appointment to the Task Committee on the National Highway Program.

The **Central Savannah River Subsection** joined with seven other technical societies in celebrating Engineers' Week in the Augusta area. The week-long program aimed at publicizing the profession to business and civic groups and high school assemblies was widely praised. The high point of the week was a dinner dance which featured a talk by David A. Keys, vice-president of the National Research Council of Canada and scientific adviser to the president of Atomic Energy of Canada, Ltd.

At its March meeting the **Hawaii Section** went on record as opposing two bills recently introduced in the Hawaii Legislature, which would remove the requirement of professional registration for engineers employed by the Territory or its various counties in the grades of P-4 (GS-11) and above. It also passed a resolution urging increased appropriations for the expansion of engineering education facilities at the University of Hawaii, which can now admit only 150 freshman engineers each year.

On the agenda at recent **Illinois Section** luncheon meetings have been talks by Bernard Bradley, of Holabird, Root & Burgee; George F. Bishop, Jr., of the Portland Cement Association; and S. J. Fraenkel, manager of the propulsion and structural research department of Armour Research Foundation.

The **Indiana Section,** with 568 members, reports that its 1955 program is in high gear. Arousing special interest was the

Student paper contest is featured at the March meeting of the Kentucky Section, held in Louisville on the 11th with Student Chapter members from the Universities of Kentucky and Louisville as guests of the Section. Here C. H. Blackman, chairman of the Section's Award Committee, presents first prize of $15 to Bob N. Hancock, member of the University of Louisville Chapter, whose paper dealt with aerial surveys. At the extreme left is William N. Benassi, member of the University of Kentucky Chapter and winner of second prize of $10 for a paper on "Traffic Engineering in New York City." Ronald Hughes, member of the University of Kentucky Chapter and winner of third prize of $5 for a paper entitled "Aluminum Company of Canada in British Columbia," is at right.

Featured speaker at widely attended meeting of the Maryland Section is Ole Singstad (right)New York City consultant, who discussed the Patapsco River Tunnel, which the Maryland State Roads Commission is building at estimated cost of $130,000,000. Others (in usual order) are Russell McCain, chairman of State Roads Commission; W. L. Chilcote, president of the Maryland Section; and Herschell Allen, president, J. E. Greiner Company, Baltimore.

Photographed at Wisconsin Section's March meeting in Milwaukee are (left to right) Joseph Bonness, Jr.; Section President Ralph Larson; Joseph F. Cairnes, executive vice-president of the Milwaukee Braves; and Lloyd Knapp, ASCE Director fro District 7. Mr. Cairnes showed a construction film entitled "Power from Niagara" and a movie depicting the highlights of the Milwaukee Braves 1954 season.

March meeting, at which Lt. Col. A. H. Lahlum, commanding officer and first engineer for the Arctic Task Force, described the tremendous efforts the military is making to develop bases 650 miles closer to the Soviet Union. He said that the development of ways and means to provide highway facilities across Greenland's permanent snow and ice cover is one of the most difficult challenges the Army has ever had to cope with. Research is being conducted "to lick the many elements that now seem almost unsurmountable—under the threat that time is running out," he said. At the February meeting O. W. Irwin, president of the Rail Steel Bar Association, gave an interesting account of developments in the rail steel bar field. He brought out the fact that there are twenty plants located throughout the country, which take the discarded rails and restore and reroll them for use in all types of structures.

Aviation activities in the Kansas City area were highlighted at the March meeting of the **Kansas City Section.** Ronald M. White, director of aviation for Kansas City, discussed the master plan for the area, a key feature of which is the new Mid-Continent International Airport northwest of the city. James T. Davis, manager of base facilities planning for Trans-World Airlines, then described the overhaul base that is being constructed at the Mid-Continent Airport, covering the servicing and maintenance of planes. Other aspects of the new overhaul base and a large hangar being built there were covered by Douglas Buchanan, manager of engineering and design for TWA, and E. J. Runyan, principal engineer of the Burns & McDonnell Engineering Co.

Construction and operation of the guided-missile testing facilities at Patrick Air Force Base, Cocoa, Fla., and on the islands of the eastern Caribbean was described in the leading talk at the **Miami Section's** February meeting by Paul Reynolds, Lieutenant (jg), CEC, USNR. Supplementary films were shown through the courtesy of the Miami Air Defense Filter Center.

Recommendations for a salary scale for architect-engineers—made by the Joint Committee on Engineers and Architects Salaries under the chairmanship of Irving Ashworth of ASCE—have been endorsed by the **Metropolitan Section** and sent to the mayor and other New York officials to aid in establishing a firm salary policy. Recent meetings have featured talks by Comdr. John J. Albers, of the Navy Civil Engineer Corps, on the island towers to be constructed on the Continental Shelf as radar platforms, and William Chapin, general manager of the New York State Power Authority, on the St. Lawrence Power Project.

New officers of the **Little Rock Branch** of the **Mid-South Section** are Robert F. Oates, president; John T. Pendergrass, vice-president; and Charles Marak, secretary-treasurer.

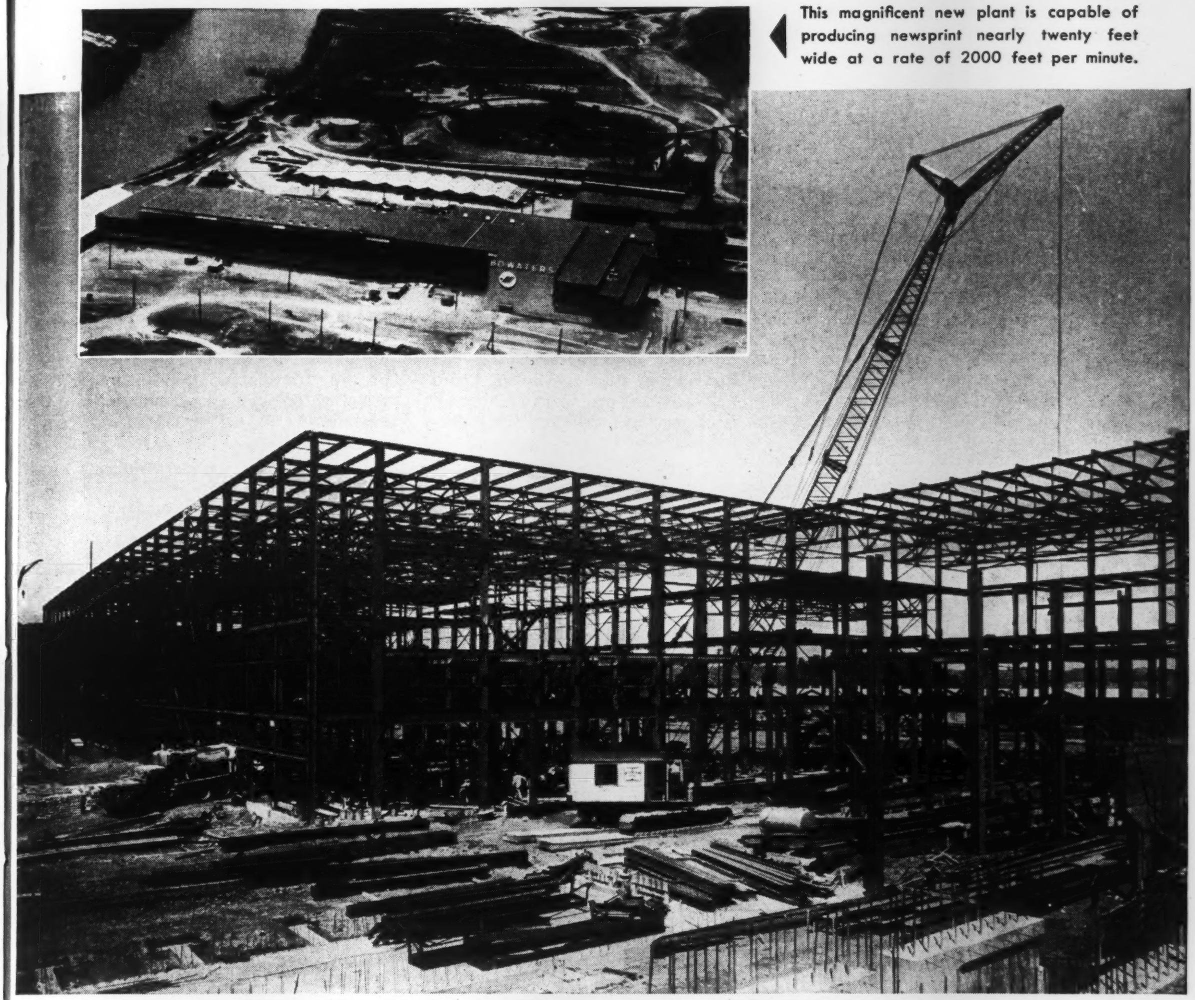
Members of the **Mohawk-Hudson Section** heard Section Member Earl Devendorf, who is also director of the Bureau of Environmental Sanitation of the New York State Department of Health, speak on "New Horizons in Environmental Sanitation," at the March meeting—a joint session with the Student Chapter at Rensselaer Polytechnic Institute. During the meeting Section President J. Sterling Kinney presented a Student Chapter banner to the Chapter as a gift from the Section.

Final plans for the District 10 Council meeting, to be held in Nashville in April, with the **Nashville Section** as host, were made at the Section's March meeting. The technical program consisted of a talk on India and Pakistan by Kenneth Cooper, professor of history at George Peabody College, who discussed the historical background of the two countries in its effect on the economic and social life.

The Junior Forum of the **National Capital Section** has started a campaign to give better service to its members and make them feel more closely identified with ASCE activities. As part of its effort the Forum shifted its April meeting out of Washington to the Engineer Center of the Corps of Engineers at Fort Belvoir. At least one-quarter of the Section's 440 Junior Members are assigned to Fort Belvoir, in either the Engineer School or the Research and Development Laboratory, and they turned out in force for the meeting on the home campus. Maj. Gen. Louis W. Prentiss, commanding general at the Engineer Center, was featured speaker with a talk on the future of the engineer.

The vital role of the military engineer in the atomic age was discussed at the **Oregon Section's** March dinner meeting in Portland—a joint program with the Society of American Military Engineers—by Brig. Gen. Louis J. Rumaggi, Assistant Chief of Engineers for Military Operations, Washington, D.C. Preceding the dinner, the joint group met at the Halsey Street Overpass over the T. H. Banfield Expressway to observe a demonstration of post-tensioning techniques presented by the Mercer Steel Company.

The **Philadelphia Section's Junior Forum** arranged the program for the annual combined meeting of the Section and its Forum in March. The featured talk—by Donald W. Korth, Jr., assistant engineer in the Philadelphia office of the Turner Construction Company—dealt with the RCA Cherry Hill Lift-Slab Project near Camden, N.J., a multi-million-dollar venture in which five interconnected buildings, varying from one to three stories in height, were occupied in less than a year after ground-breaking. The Forum received high praise from the Section, which has dubbed it an "aggressive group of young civil engineers, which has long proved to be a fountainhead of



This magnificent new plant is capable of producing newsprint nearly twenty feet wide at a rate of 2000 feet per minute.

Main building shown at the completion of steelwork. Engineer for the project was J. E. Sirrine Co., Greenville, S. C., aided by Celli-Flynn of McKeesport, Pa., consulting architects. Construction was a joint venture of Turner Construction Co. and Fraser, Brace & Co.

Titan in Tennessee

The giant mill shown above is Bowaters Southern Paper Corporation's newsprint plant on the Hiwassee River at Calhoun, about 40 miles northeast of Chattanooga. Put into operation in mid-1954, the British-owned plant was designed to produce 130,000 tons of newsprint and 55,000 tons of kraft pulp per year.

Dominating the plant is the huge main building. Over 1000 feet long and covering 5½ acres, it includes a pulp-drying and machine room, a storage-and-shipping bay, a bleaching plant, a stock-preparation room, a grinder room, and shop and stores facilities. Nearby stands the power house which contains four boilers and two 10,000-kw turbo-generators. The third structure serves as a pumping station and filtration plant.

Steelwork Erected Fast with High-Strength Bolts

These three buildings required over 7500 tons of structural steel, fabricated by Bethlehem at our shops in Rankin and Leetsdale, both in western Pennsylvania.

Shop connections were riveted. However, all field joints were bolted. Out of the 196,635 bolts used, 170,203 were high-strength bolts meeting ASTM A-325. The remainder were common machine bolts.

High-strength structural bolting, a technique pioneered by Bethlehem, assured tighter joints than field-driven rivets. In addition, fewer men and less equipment were required, and the job was materially speeded. Thanks to bolting, and to meticulous job planning, Bethlehem crews completed erection in only 20 weeks.

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progress within our established organization."

At the March meeting of the **Junior Forum** of the **Sacramento Section** the presentation of an experimental program aimed at fostering student interest in careers in engineering was favorably received. Some 50 students and Junior Forum members turned out to hear and enter into a panel discussion of "Engineering as a Profession." The panel consisted of four engineering students from Sacramento Junior College and a like number of engineers representing civil, mechanical and electrical fields of engineering endeavor. Russ Parker, Ed Sylvester, Franklin Spencer and Jim Reynolds performed as student members, and Herbert Greydanus, Robert Grant, Richard Fuller and James Wyatt as engineer members of the panel. Wesley Steiner served as moderator. The discussion revealed student awareness of many of the problems now confronting the engineering profession.

Virgil Jaenicke, student member at the San Diego State College, received the **San Diego Section's** Student Prize Award for his paper on "Horizontal Control in Long Tunnels," presented at the San Diego Convention student contest. In a talk on corrosion problems, Harry J. Keeling, consulting mechanical and electrical engineer Los Angeles, discussed problems in water and gas pipe lines, accompanying his talk with schematic sketches of corrosion cells from the simplest type of pipe circuits to complex cells of many circuits.

A lively discussion of transit problems, with emphasis on local conditions, engaged members of the **Syracuse Section** at the March 22 meeting. Representatives of local government, retail business, industry, etc., were present in force to aid in arriving at a solution for the city's pressing transportation problem. A General Electric movie supplemented the discussion.

Connecticut Section Host to ASCE Local Section Conference and New England Council Meeting

With the Connecticut Section as host, two important Society events took place in Hartford, Conn., the end of March. On the 24th and 25th there was a Local Section Conference, notable for being the first such conference ever held separately from a Convention of the Society and also for being the first conference in the East to which Junior Members were invited as delegates. The other important event was the Second Regional Conference of the New England Council of Sections held on the 26th.

Local Section Conference

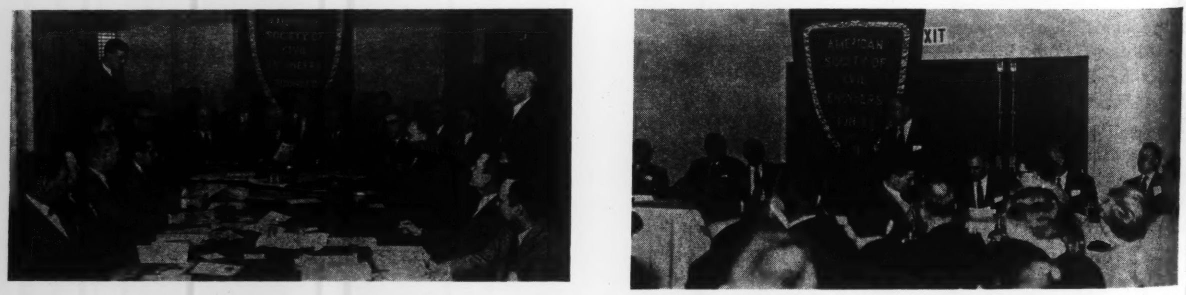
Many new ideas for improved conduct of the Society at Local Section level were brought out by the forty representatives of Northeastern Sections attending the two-day Local Section Conference. In the lead-off talk on "ASCE Progress, a Function of Local Section Activity," ASCE Vice-President Enoch R. Needles set the pace for the unusually stimulating two-day discussion of all phases of Section operation. A few of the topics covered were "Effective Section Programs Build Attendance and Participation," by Robert B. Moorman, president of the Syracuse Section; "Organization and Operation of Subsections and Branches," by William P. Kimball, president of the recently formed but flourishing New Hampshire Branch of the Maine Section; "Local Section Publications Boost Section Membership," by Robert C. Haraden, secretary of the Maine Section, a relatively new Section, which has from the outset boasted a comprehensive and interesting news bulletin; and "Organization of Local Section Technical Activities," by Arthur J. Fox, Jr., who recently aided in the organization of a highly successful Sanitary Engineering Group within the Metropolitan Section, of which he is secretary.

Don P. Reynolds, Assistant to the Secretary of ASCE, discussed the integration of Junior Members into Section responsibilities and activities. In addition to the scheduled speakers, there were several periods open to informal discussion by the delegates, with each limited to two minutes. Carl G. Paulsen, Board Contact Member for the Society's Committee on Local Sections, was the presiding officer.

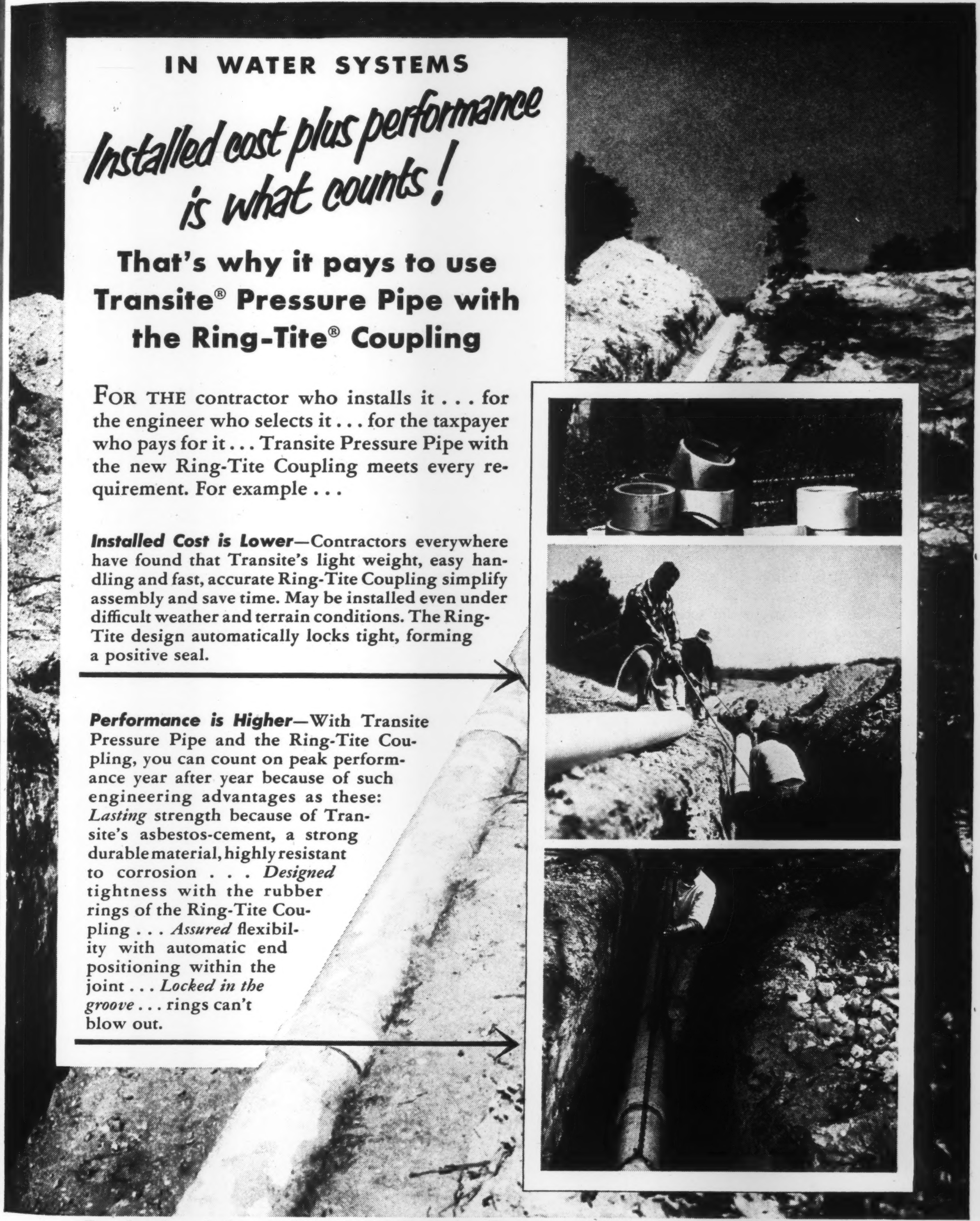
New England Council Meets

There was an attendance of more than 200 at the all-day meeting of the New England Council. The technical program consisted of panel discussions on the Greenwich-Killingly Expressway, presented by members of the Connecticut State Highway Department; pollution abatement in New England, presented by members of the New England Interstate Pollution Control Commission; and community planning in New England, given by a panel under the leadership of Donald Graham, secretary of the Society's City Planning Division. In the featured talk at the Council's luncheon meeting, ASCE President William R. Glidden outlined recent Society developments including the increased allotment to Sections and another projected salary survey. Carleton F. Sharpe, city manager of Hartford, was guest speaker at the dinner meeting. His talk dealt with the engineer in city planning and the value of his talents.

The third regional conference will be held in Providence next March with the Providence Section as host.



Delegates from Local Sections in the Northeast meet in Hartford (left-hand view) for the first Local Section Conference ever held apart from a Society Convention. At the head table at the New England Council luncheon are (left to right in right-hand photo) former ASCE Director Harold L. Blakeslee; ASCE Past-President R. E. Dougherty; former Director Frank A. Marston; Waldo W. Smith, vice-president of New England Council; ASCE President William R. Glidden; Earl R. Howard, president of N.E. Council; ASCE Director Frederick Paulson; Emory Ireland, N.E. Council secretary; and Don P. Reynolds, assistant to the ASCE Secretary.



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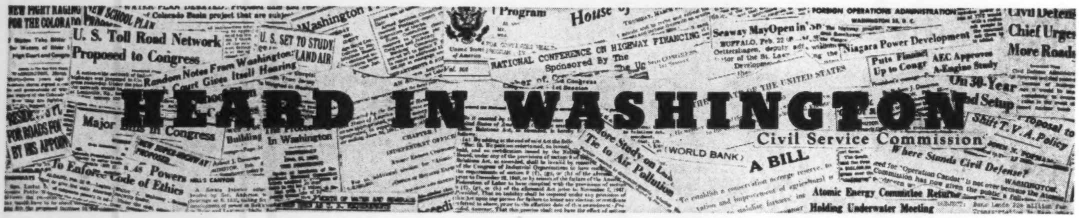

HEARD IN WASHINGTON

JOSEPH H. EHLERS, M. ASCE — **Field Representative ASCE**

Hearings on highway legislation ended in the Senate and began in the House. The Clay plan was thoroughly mauled in the Senate Committee despite a preponderance of favorable testimony. During the last week, however, the Committee appeared to be impressed with the outstanding importance of the Interstate System. Many perplexing questions remain unanswered. ASCE submitted a statement dealing with the adequacy of engineering manpower and the justification for a high priority for the Interstate System in respect to federal contributions and to building to advance engineering standards.

Foreign aid looms large again. The President asked Congress for $3.5 billion for the coming fiscal year. A major part will go to Asian countries. Economic aid through loans and grants, for technical assistance and for development projects, would total $712 million.

The Defense Department has asked Congress for authority to spend $2.3 billion on construction in fiscal year 1956, including $1 billion for overseas work. The Air Force would get half the total; $330 million would be for military housing.

S.500, the controversial Upper Colorado River project bill, with the much debated Echo Park Dam included, has received Senate approval by a large majority. Passage by the House is less likely.

The $310 million **John Day Dam** on the Columbia River, previously authorized, would be 90 percent paid for by state and local interests under terms of H.R. 5789. The federal government would pay the other 10 percent.

A number of inquirers have asked about a **National Academy of Engineers and Contractors** and a related **Construction Industry Advisory Council.** This appears to be in the nature of a trade association of subcontractors, contractors, and others. It does not appear to have any connection whatever with the National Academy of Science with which ASCE has close ties through the Engineering Division of the National Research Council. Similarly, it is authoritatively stated that this new group is not the Construction Industry Advisory Council sponsored by the U. S. Chamber of Commerce on which ASCE has had representation for some years. Further inquiries may be directed to our Washington office.

Hearings are under way on H.R. 2847, introduced by Congressman Carl Hinshaw, M.ASCE, which would establish a **Scientific Specialists Board** to handle deferments from call to military service for scientists and engineers whose services were more necessary elsewhere in the interest of national defense.

Civil Service Advisory Committee on Engineers Meets

Since the welfare of the federal engineer employee is and should be a matter of major interest to the Society, the recent meeting of the Advisory Committee on Engineers to the Civil Service Commission deserves notice. (Photo of committee personnel on page 80.)

In connection with the problem of increasing the prestige of the government's corps of 47,000 engineers, the Advisory Committee suggested to the Commission that stricter standards be established in making future appointments. Those included are absolute requirement of a bachelor's degree in engineering for entry into the two lowest grades, Engineer GS-5 and Engineer GS-7; an examination for proficiency for entry into the intermediate grades; and adequate professional standing and recognition for promotion to Engineer GS-13 and higher grades. Such professional status might be shown by engineering registration in a state, by membership in the appropriate grade of certain technical societies, or by an equivalent investigation of professional stature by the Commission.

Faced with the shortage of engineers, there has been a tendency to lower the standards. The Committee believed that the opposite approach of raising standards would obtain better results in getting and keeping good engineers in government. The problem of interesting young graduates in government service was fully considered.

The Committee commended the Commission on presenting an acceptable pay bill and on increasing the entering salaries in certain hard-to-fill engineering jobs, matters which had been under discussion by this Committee for some time. A clear separation of professional engineering from technician jobs in government was also recommended as a means of relieving professional workers from the performance of non-professional work especially while the current shortage of engineers lasts.

Background of Advisory Committee

Although this Committee has no relationship to ASCE, it was established by the Commission following a recommendation of Engineers Joint Council. Members are appointed by the chairman of the Civil Service Commission from engineers in government, in private practice, and in the educational field. The Committee was set up to give the Civil Service Commission the benefit of independent thinking and objective appraisals of its policies towards engineers in Government and to recommend changes in policies which might improve the recruitment and career development system. Making recommendations which will help build up a government engineer corps of which all engineer employees will be proud is a general long-range objective of the committee.

Washington, D.C.
April 22, 1955

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NEWS BRIEFS . . .

Record March Construction Activity Brings First-Quarter Expenditures to New High

The value of new construction put in place expanded seasonally in March to $2.9 billion, setting a new high for the month and closing out the most active first quarter on record, according to preliminary joint estimates of the Departments of Commerce and Labor. March activity brought the first-quarter total to $8.4 billion, a 13 percent increase over the previous January-March high achieved in 1954. On a seasonally adjusted basis, new construction activity in the first quarter of this year reached the unprecedented annual rate of $41 billion, compared with an annual rate of $38 billion in the preceding quarter and actual expenditures of $37.2 billion for 1954.

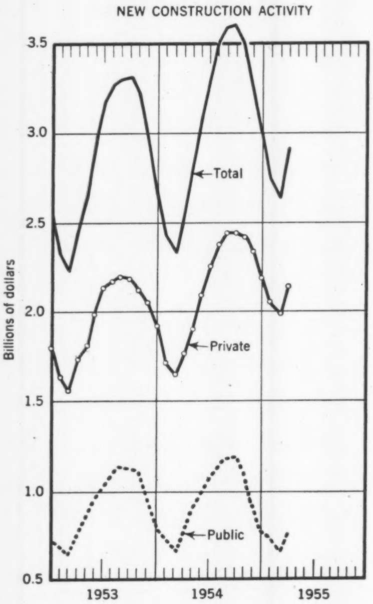
Increased activity in almost all types of private work was the dominant factor in the record rate. Private expenditures, which accounted for nearly three-fourths of all new construction activity during the January-March period, totaled $6.2 billion, an all-time high for the period and 20 percent more than private construction outlays in the previous record first quarter (1954). Public outlays for construction during the first three months of this year, at $2.2 billion, were 4 percent less than in the first quarter of 1954, as continued declines in public housing activity and most types of direct federal construction more than offset a sustained expansion in state and local public works.

Although private residential building activity increased slightly less than seasonally from the high February level, March 1955 outlays were at a new peak for the month, completing a record first quarter with $3.3 billion of work put in place. This was a 35 percent increase over the January-March 1954 period and, after adjustment for construction cost changes, represented one-fifth more private residential building than was accomplished in the previous peak first quarter of 1951.

Other types of private construction which set new first-quarter records for work put in place were commercial, religious, and educational building. A moderate recovery for industrial building activity resulted in a 6 percent increase in the first quarter of 1955 as compared with the same period last year, but outlays were 10 percent less than at the all-time peak shown for private industrial building in the January-March 1952 period. With the exception of railroad construction public utility companies showed greater expansion than in the first quarter of a year ago.

So far in 1955, expenditures for nearly all important types of state and local public works have continued to set new records. Compared with the earlier first quarter peaks of 1954, public school building activity was up by 16 percent, sewer and water work by 8 percent, and new highway construction by 6 percent.

The value of work put in place on federally owned projects during the first quarter of the year was nearly one-fourth less than similar outlays in the corresponding 1954 period, with reduced activity reported for all major classes of work except military facilities.



March construction activity, at $2.9 billion, sets a record for the month and brings the first-quarter construction total to an all-time high.

Structural Steel Erected for Socony-Vacuum Building

Structural steel skeleton for new Socony-Vacuum Building rises in mid-town Manhattan (Chrysler Tower in background). Flooring formwork will be poured with 4 in. of Gritcrete, a lightweight concrete which will be structurally reinforced with welded wire fabric. Stainless steel has been selected as the exterior sheathing for the 42-story structure which will be the largest metal-clad building in the world. Ground was broken for the project in March 1954, with completion planned for July 1956. Edwards & Hjorth, of New York, are the structural engineers, and Harrison & Abramovitz and John B. Peterkin, the associate architects. General contractor is the Turner Construction Company. Wire Reinforcement Institute photo.

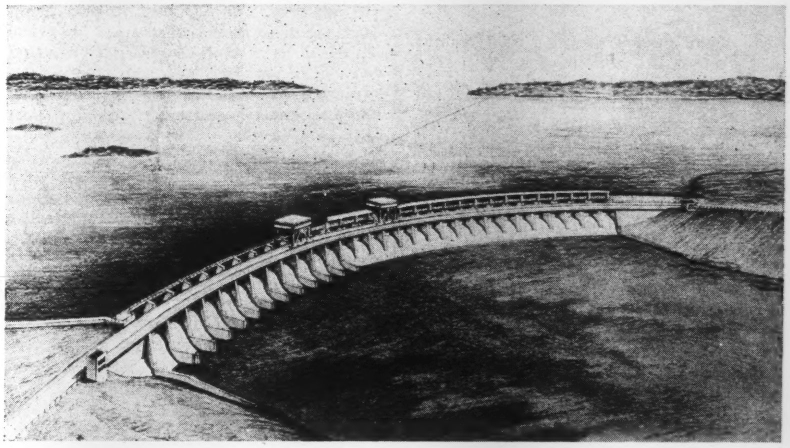
AWWA Elects New Officers

The American Water Works Association announces the election of officers for 1955. Frank C. Amsbary, Jr., M. ASCE, vice-president and manager of the Northern Illinois Water Corp., Champaign, Ill., will be president; Paul Weir, M. ASCE, general manager of the Atlanta Water Works, vice-president; and William W. Brush, M. ASCE, editor of *Water Works Engineering*, New York, treasurer.

Elected to honorary membership are ASCE Members Louis E. Ayres, consulting engineer of Ann Arbor, Mich., and Linn H. Enslow, editor of *Water and Sewage Works*, New York. Paul D. Haney, M. ASCE, of Cincinnati, receives the organization's Goodell Prize for his paper entitled "Theoretical Principles of Aeration" as well as the Purification Division Award for his chairmanship of a task force reporting on "Characteristics and Effects of Synthetic Detergents." H. E. Hudson, Jr., M. ASCE, of Champaign, Ill., will receive the Resources Division Award.

Installation of officers and presentation of awards will take place at the annual meeting of the AWWA, to be held in Chicago, June 12–17.

Keen Competition Marks Long Sault Dam Bidding



Long Sault Dam, shown here in artist's sketch, will close the river channel near the head of Barnhart Island. It will be entirely in the United States. The successful bidder estimates that as many as 1,200 men will be employed on the job at peak construction.

Low bidder by less than one-tenth of 1 percent, a joint venture headed by the Walsh Construction Company has won a $25,972,033 contract from the Power Authority of the State of New York for construction of Long Sault Dam on the St. Lawrence River. A total of 43 construction firms in eight joint ventures submitted eight bids, ranging from the low to a high of $34,363,205. The successful combine's low bid was an alternate—approximately one bag of natural cement to four bags of portland. Its gross bid was $26,018,923. There was no engineers' estimate. In addition to the Walsh Company, the firms included in the joint venture are B. Perini & Sons, Inc., Morrison-Knudsen Company, Inc., Peter Kiewit Company, and the Utah Construction Company.

The contract calls for construction to start at once and for completion of the project on or before December 30, 1958. Construction will be maintained on a twelve-month basis.

A pool-regulating structure, Long Sault Dam will be the first of three dams to be constructed in the St. Lawrence Power Project. The others will be the Barnhart Island Dam and Power Plant, which will involve $121.5 million worth of construction on the U. S. side, and Iroquois Dam.

Firms Pool Facilities to Form Exploration Group

Pooling of the facilities of three organizations, with a combined staff of more than 500 scientists, engineers and technicians, to form an International Resources Engineering and Exploration Group (IREX) is announced by Brown & Blauvelt, consulting engineers of New York and one of the participating firms. Other members of the new group are Jack Amman Photogrammetric Engineers of San Antonio, Tex., and Geophoto Services, consulting geologists of Denver, Colo. Formation of IREX does not represent a merger, but coordinates the related facilities of the three companies to provide an integrated service in all phases of natural resource studies.

IREX offices will be located in Washington, Denver, San Antonio, New York, and Calgary, Canada.

Virginia Highway Survey Improves Salary Schedule

The Virginia Highway Department reports that improved salary schedules for its key engineering positions have been obtained as a direct result of a recent management survey for which the services of an engineering firm were retained. The survey, which was begun May 1, 1954, and completed in September, included a study of the entire organizational setup, internal operations, and the functions of each division including the question of whether or not divisions, subsections, and individuals were carrying a proper share of the work load. It also included a study of the department's classification plan and salary structure. Griffenhagen and Associates, of Chicago, were the engineers.

The report was submitted to the governor, who had originally authorized the study, with a request to revise salary schedules for key engineering positions effective January 1. In line with additional recommendations resulting from the study, the Highway Department is reviewing other engineering and subprofessional classifications.

Improved salary schedules currently in effect for key positions show an increase of about 20 percent for the Chief Engineer, whose salary range is now $10,032 to $12,528, in comparison with old-scale rates of $8,400 to $10,512; about 20 percent for Assistant Chief Engineer, with salary range from $8,784 to $10,992, compared with the former range from $7,344 to $9,168; about 5 percent for Division Head, with the range from $7,680 to $9,600, compared with $7,344 to $9,168; about 5 percent for Assistant Division head, with salaries ranging from $6,432 to $8,040, compared with $6,144 to $7,680; about 9 percent for District Engineer, with salaries ranging from $7,032 to $8,784, compared with $6,432 to $8,040; 9 percent for Resident Engineer, with salaries ranging from $5,640 to $7,032, compared with $5,160 to $6,432; about 9 percent for Assistant Resident Engineer, with salaries ranging from $4,512 to $5,640, compared with $4,128 to $5,160; and about 5 percent for Highway Engineer Trainee with salaries ranging from $3,936 to $4,920, compared with $3,744 to $4,704.

ASME Sponsors Meeting On Air Pollution Control

The need for state-level legislation and organization for control of air pollution was stressed at the recent First International Congress on Air Pollution, held in New York. Sponsored by the American Society of Mechanical Engineers as part of its 75th anniversary celebration, the meeting was attended by experts from seven countries.

In a leading speech Arthur C. Stern, chief of the Air Pollution Control Program of the U.S. Department of Health, Education and Welfare at Cincinnati, Ohio, reported that large areas of the United States are without effective government regulation of air pollution. Estimates indicate, he said, that air pollution is recognized as a problem in close to 10,000 United States communities. This estimate is based on a recent detailed survey of the situation in New York State, showing that 252 urban and 203 rural and suburban communities have air pollution control problems. However, no local air pollution or smoke control ordinances exist in about 55 percent of the New York State urban communities and in about 85 percent of the state's rural communities.

Mr. Stern believes that, in the long run, it is poor public policy for federal agencies to give direct assistance and guidance to local communities that have no personnel adequately trained to administer a control program. In his opinion, the best means of solving the problem are the county-wide or multi-county regional administrative units similar to that set up in the San Francisco Bay area. In some cases, he says, it may be necessary to set up interstate agencies, such as have sucessfully solved interstate problems of water supply, water pollution, bridge and port construction.

Copies of Mr. Stern's paper (No. 55-APC-15) may be obtained at 50 cents each from the Order Department of the ASME, 29 West 39th Street, New York 18.

Contract for Alaska Airport Expansion

A $4,812,102 contract for construction of extensive additions to the U.S. Air Force installation at Galena Airport in Alaska has been awarded to Peter Kiewit Sons Company, Seattle, Wash., according to an announcement from the Alaska District of the Corps of Engineers. The bid was the low among seven, some of which ran as high as $7,000,000.

The project, which will transform Galena from a minor installation into a base of major importance, is located on the Yukon River halfway between Nome and Fairbanks. Completion by September 1956 is planned.

Contract for Baltimore Harbor Tunnel Awarded

Award of a $29,894,081 low-bid contract to the Merritt-Chapman & Scott Corporation, of New York, for construction of a twin-tube tunnel under Baltimore Harbor is announced by the Maryland State Roads Commission. The trench-type tunnel will be about 6,300 ft long, running from a point on the south shore of the Patapsco River to a point on the north shore. Each of the twin tubes will carry two lanes of traffic. The tunnel, together with its 14.3 miles of approaches, will provide an express route through the southeastern and southern sections of the city, linking U.S. Route 1 on the south with U.S. 40 on the north. Work on the project will start this spring, and completion is scheduled for December 1, 1957.

The New York firm of Singstad & Baillie was the designer, and the J. E. Greiner Company, of Baltimore, the consulting engineers for the project. The 21 twin-tube sections will be fabricated under subcontract from Merritt-Chapman & Scott at three different shipyards—the Camden yard of the New York Shipbuilding Corporation, the Sparrows Point yard of the Bethlehem Steel Company, and the Baltimore yard of the Maryland Drydock Company.

Steel Mill Improvements Cost $680 Million in 1954

Expenditures totaling $680 million were made last year by the iron and steel companies of the United States, in improvement and expansion of their plants, the American Iron and Steel Institute reports. This was in addition to the $5.6 billion already spent for new equipment and construction during the eight postwar years, 1946 to 1953.

Many new facilities came into operation during 1954. These included several new electric steelmaking furnaces, two new blast furnaces, a new continuous hot sheet and strip mill, new annealing facilities, a new cold rolled strip mill, the replacement of old by-product coke ovens, and much other equipment.

With the construction and agricultural industries creating heavy demands for galvanized steel sheets, some companies have been investing in continuous galvanizing equipment. There are approximately 22 continuous hot dip galvanizing lines in operation. Five more are reported being built and nine are being planned.

The nine-year outlay, totaling $6.3 billion, will be augmented by another heavy investment during 1955. The price tag this year may total $695 million, according to advance estimates reported by the companies. Almost every concern in the industry has plans for capital improvements and expansion.

Shawnee Steam Plant Fueled by Three-Mile Conveyor

Three-mile network of rubber conveyor belts, operating in four directions at once, supplies 14,000 tons of fuel a day for the ten 150,000-kw generating units of the nation's largest power plant—the Tennessee Valley Authority's Shawnee Steam Plant at Chiles, Ky. This aerial view of the plant, looking south from the Ohio River, shows the barge-unloading dock in the foreground, condenser cooling water intake channel at the left, and discharge channel at the right. The conveyor belt system, supported by towers, crosses the discharge channel on its 2,640-ft trip from river to crusher building at the plant site. The conveyor belting was manufactured by the Industrial Products Division of the B. F. Goodrich Company, Akron, Ohio. Electric power produced at the Shawnee plant is fed to the AEC's gaseous diffusion plant at Paducah. In partial operation since early 1953, the Shawnee plant will go into full operation late in 1955.

First Use of High-Tensile Bolts in New York Building

Photo shows last of 1,200 tons of steel being erected. Small view shows bolts being pulled up by Chicago-Pneumatic impact wrench. Wrench can be set to idle when desired tension is in bolt. Note that all shop connections were riveted.

The first structure entirely field connected with high-tensile bolts to be erected in New York City has been topped out. The design of the 18-story apartment building on lower Park Avenue was changed to high-tensile bolts when difficulty was experienced in finding riveting teams. Using the same connections as were designed for rivets, the cost of the bolted structure proved no greater than a riveted job—despite increased inspection costs amounting to about $3 per ton. It is believed that this inspection cost can be reduced on future jobs.

The builder and owner, Anthony Campagna and Sons, expressed satisfaction with the bolted structure since the building will be ready for occupancy three weeks ahead of schedule. The superintendent noted greater stiffness in the relatively narrow structure during plumbing and steel erection. Training of the two-man bolting teams presented no problem, and production was about 450 bolts per day per team. Noise was reduced roughly 50 percent. The bolts were made of heat-treated, medium carbon steel with an ultimate strength of 120,000 psi.

Engineers for the project were Weinberger and Weishoff, and the architects were Sylvan Bien—Robert L. Bien. Steel was fabricated by Grand Iron Works, and the 35,000 connectors on the project were supplied by Russell, Burdsall & Ward of Port Chester, N.Y.

Private Groups Plan to Build Atomic Plants

Plans are being made by four private and public utility groups to build demonstration nuclear reactor plants capable of producing 455,000 kw of electric power, according to the Atomic Energy Commission. These plants will cost a total of $150,000,000. From 80 to 90 percent of their cost would be furnished by the private groups. In making the announcement, AEC Chairman Lewis E. Strauss said the plants would be considered "on a competitive basis within the limits of the funds and materials available to the Commission for the program."

The four groups with concrete plans are the Nuclear Power Group, which would build a 180,000-kw plant in the Chicago area, to be completed in 1960; the Yankee Atomic Electric Company of Boston, consisting of twelve power companies serving the New England states, which is planning to complete a 100,000-kw plant in the western Massachusetts area by late 1957; Atomic Power Development Associates, which expects to build a 100,000-kw plant in the Detroit area by late 1958; and the Consumers Public Power District of Columbus, Nebr., which is planning to build a 75,000-kw plant, to be completed in 1959.

The new plants will be in addition to the $55,000,000, 250,000-kw atomic electric generating plant the Consolidated Edison Company is proposing to build near Peekskill, N.Y. (March issue, page 82). With the proposed Consolidated Edison plant, the new projects would have a total capacity of 705,000 kw—about three-quarters of 1 percent of the present electrical generating capacity of the country.

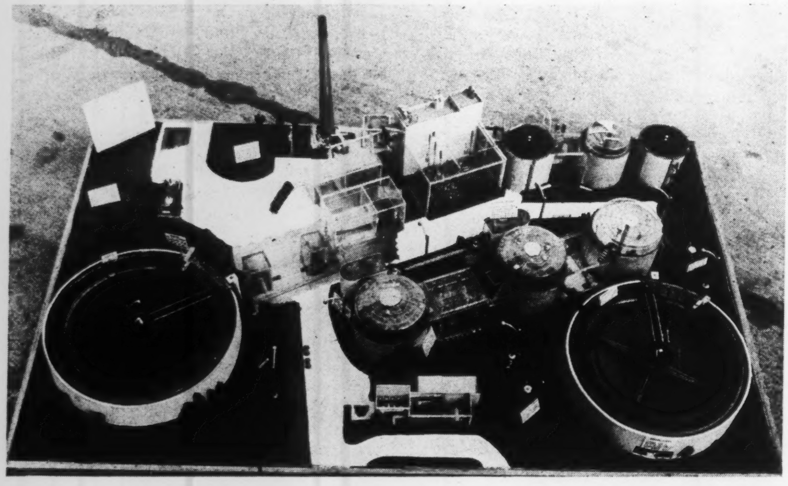
Several other groups have plans that are still in an embryonic state. The Philadephia Electric Company has announced that it and eight other utilities are seeking authority to build and operate a breeder reactor. A group called the Seminole Electric Cooperative, Inc., has been formed at Madison. Fla., to study the feasibility of building a small 10,000-kw plant, with the aim of reducing costs in north central Florida. A definite proposal is expected from a third combine of utilities, the Rocky Mountain Power Group, which is said to be ready to develop a 60,000-kw reactor in the near future.

Chairman Strauss hailed the proposals as "significant proof that industry is willing to risk its own capital to speed development of atomic power for peacetime uses."

Army Dedicates Huge Everglades Pumping Station

As the key unit in a vast flood-control system designed to protect the Florida Everglades area against floods and reclaim millions of acres of rich farm land, this huge pumping station went into service on March 19 in ceremonies headed by the Army Corps of Engineers. Located at 20-Mile Bend, midway between Lake Okeechobee and West Palm Beach, the new station houses six 116-in. Fairbanks-Morse pumps with a combined capacity of more than 3 billion gpd, making it the world's largest low-lift pump plant. Only the higher lift stations at Grand Coulee Dam and Mill Creek, Cincinnati, can pump more water. Each of the new pumps is driven by a 1,600-hp Fairbanks-Morse opposed-piston diesel, enabling the plant to function when electric power lines are disrupted. The Corps of Engineers has been planning the project since the disastrous 1947 floods. The state has paid about 40 percent of the $300,000,000 cost of the project.

San Diego City Employees Build Model of Treatment Plant



Object of much attention at the recent San Diego Convention was this up-to-date model of the San Diego sewage treatment plant on display in the lobby of the headquarters hotel. Constructed by employees of the Department of Public Works under the supervision of Richard Gallagher, director, the model simulates sewage and sludge pumping by means of colored water. Sludge gas is burned in the waste burners, which utilize butane gas for the purpose. All pumping and electrical equipment for operation of the model is housed within the interior and is readily accessible through removable panels. The model is proving highly popular for in-service training and lectures to school groups and Student Chapter groups.

Peru Receives I. B. Funds For Irrigation Project

The International Bank for Reconstruction and Development has made an $18,000,000 loan to Peru to help finance an irrigation project, which will make productive some 125,000 acres of arid land. The project is located near the town of Piura, the capital of a large agricultural and industrial region 600 miles north of Lima. It is being carried out in two stages, the first of which was completed by the Peruvian government in December 1953.

The second stage of the project will involve construction of a dam and reservoir, and the building of 53 miles of main canals and 200 miles of lateral canals. Total cost of the project will be in the neighborhood of $28,500,000.

B. R. I. Studies Needs Of Building Industry

In a recent two-day meeting at Princeton University members of the Building Research Institute sought answers to the design, equipment, and materials problems that beset the building industry. Sessions included discussions of such subjects as "Integration of Electrical Systems with Structure," "Methods of Noise Reduction," "Prefabrication of Homes: What It Demands of Building Products and Equipment," "Lift-Slab Construction," and "Building Problems of Building Owners."

During the discussion of prefabrication a number of interesting points were developed.

It was noted that with regard to small homes, lumber is still the major material and the lumber-producing industry is one of the least efficient in the country. Log wastes run as high as 50 percent in the Northwest and 70 percent in the South. Here, then, the panel felt was a good place to look for cost-saving methods. Another prefabricator suggested that structural adhesives would mean saving in buildings since a glued joint is much more efficient than a nailed one. Further, a need for a new structural grade of lumber was expressed, so that timbers could be interchangeable throughout the structure.

In prefabrication particularly, a greater knowledge of lightweight materials was thought to be necessary so as to reduce shipping costs. Building owners expressed a need for greater control over quality of construction and for closer tolerances in the fabrication of subassemblies.

Present at the meeting were 200 of the nation's leading building designers, contractors, and suppliers. If answers to the industry's problems are to be found, these are the men who will find them.

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Special Prices Offered On Geologic Glossary

Some 2,600 of the more commonly used geologic terms used by geologists, engineers, and professional men in allied fields are clearly and concisely defined in the *Glossary of Selected Geologic Terms*, by W. L. Stokes and D. J. Varnes, soon to be published as Volume 16 of the Proceedings of the Colorado Scientific Society. Orders for this volume, at prepublication prices of $2.50 cloth bound and $2 paper bound, are being accepted until May 15. Orders and checks should be sent to the Treasurer, Colorado Scientific Society, Box 688, Denver, Colo. The regular price is tentatively placed at $3.50 for cloth bound copies and $2.75 for paper bound.

With the emphasis in selection of terms slanted toward the overlapping fields of engineering and geology, the publication is said to be supplemental to, rather than competitive with, other important glossaries of geologic terms.

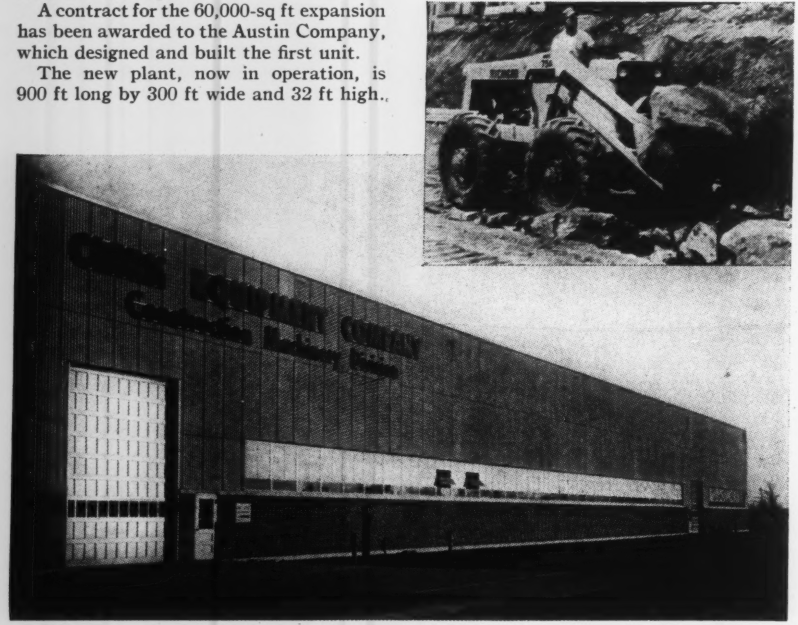
Clark Equipment Company to Expand New Plant

The Clark Equipment Company has announced plans for a 60,000-sq ft expansion to its 150,000-sq ft Benton Harbor (Mich.) Plant, which produced its first unit only last November. George Spatta, president, stated that "The original structure. . .was, of course, designed to facilitate economical and efficient expansion. But at the time we undertook the building program a year ago, we did not believe our plans for expansion would materialize so quickly." This announcement was made at an extensive equipment seminar held at St. Joseph, Mich. Officials of the company discussed principles and features of the equipment at some length. A subsequent tour of the plant was made by members of the press.

A contract for the 60,000-sq ft expansion has been awarded to the Austin Company, which designed and built the first unit.

The new plant, now in operation, is 900 ft long by 300 ft wide and 32 ft high. The frame is steel columns on 40 by 60-ft centers, with clear-span roof trusses in the long direction. An all-metal deck with 1-in. fiberglas insulation forms the roof, which is surfaced with four-ply built-up tar and gravel. The lower 7 ft of wall are concrete block with brick facing, 5-ft steel sash and 20 ft of corrugated asbestos siding backed up with 2 in. of tectum insulation.

Three principal operations to be performed at the plant are the making and forming of raw steel into main components, welding, and subassembly and final assembly. Clark's complete line of tractor shovels and excavator cranes will be produced at the plant.



New 150,000-sq ft Benton Harbor Plant of the Clark Equipment Company, in operation since November 1954, is slated for 40 percent expansion of plant. Contracts for work have been let to the Austin Company. Michigan tractor shovel shown (in small photo) handling heavy rock is part of line of ten tractor shovels and excavator cranes to be manufactured at plant.

NUCLEAR NOTES

XI—Techniques of Radiation Measurement (Part 1)

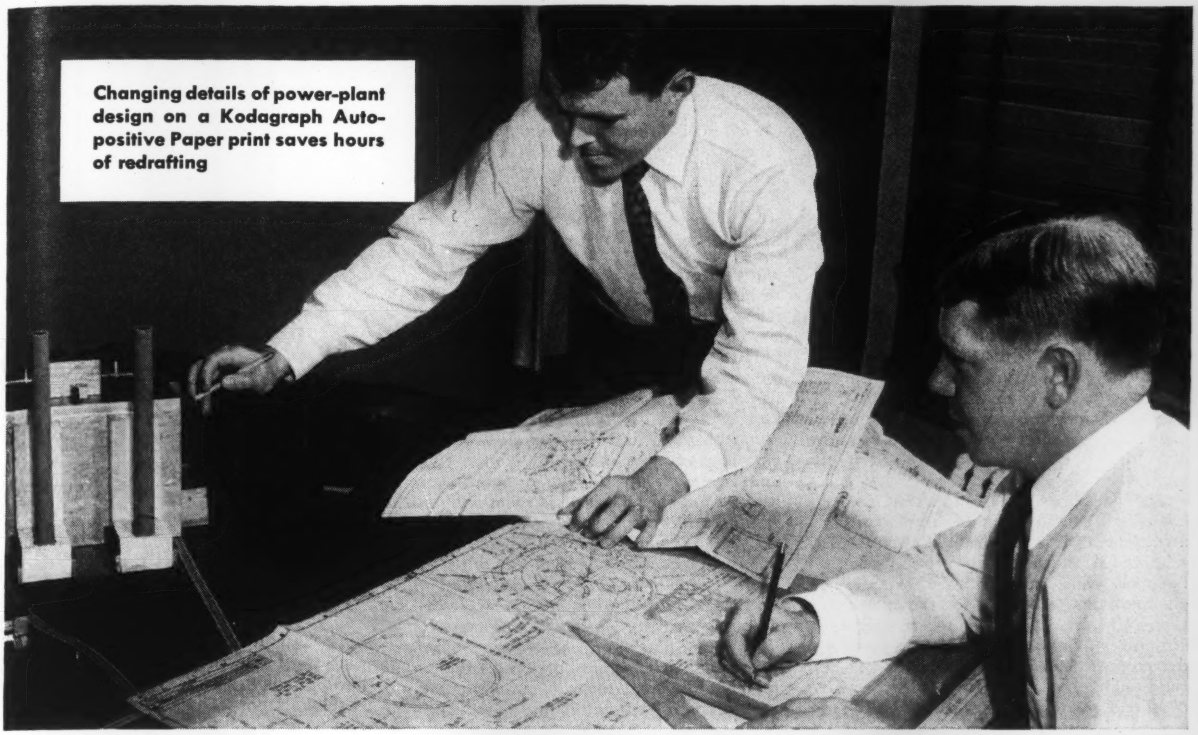
This installment of "Nuclear Notes" was prepared at the request of the Sanitary Engineering Division's Committee on Sanitary Engineering Aspects of Nuclear Energy by Morton I. Goldman, J. M. ASCE, Senior Assistant Sanitary Engineer, Robert A. Taft Sanitary Engineering Center, USPHS, assigned to the Oak Ridge National Laboratory, Oak Ridge, Tenn. Conrad P. Straub, of the Oak Ridge National Laboratory, heads the committee, which also includes Earnest F. Gloyna, A. E. Gorman, Prof. Warren J. Kaufman, Alexander Rihm, Jr., and James G. Terrill, Jr. Next month's article will complete the description of the techniques of measurement.

In previous articles, instruments used for the measurement of radiation have been described. Intelligent application of these instruments to particular measurement problems requires a knowledge of their selectivity, sensitivity, and efficiency characteristics. The efficiency is largely dependent upon the geometrical relationship existing between the source and the detector, the energy of the emitted radiations, and the type of radiation (alpha, beta, or gamma).

Essentially all measurements of radioactivity can be classified as either absolute or comparative. Absolute measurement implies a determination of the disintegration rate of the sample in curies of radioactive material present. This is the most difficult of all radioactivity measurements, requiring a knowledge of all the correction factors applicable to the particular counter and sample arrangement. Although such measurements are made infrequently in most isotope research, they are required when the exact amount of radioisotope for medical application, or that present in air or water must be known.

In comparative measurements, which comprise the majority of all counting determinations, the activity of a sample which has undergone some processing is compared to the activity of a control. The change in activity of the experimental sample compared to that of the control indicates the effect of processing; for example, the efficiency of extraction from, or uptake by, a particular process or system is determined by comparing the initial and final sample activities. The validity of such measurements is based on the absence of other variables—a requirement which is usually not too difficult to achieve.

(*Continued on page 90*)



Changing details of power-plant design on a Kodagraph Autopositive Paper print saves hours of redrafting

Toledo Edison Company reports on its use of Autopositive—

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Shortly after Kodagraph Autopositive Paper was introduced, the Toledo Edison Company, Toledo, Ohio, began exploring its possibilities for engineering drawing reproduction.

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☐ **Print-making simplified.** Toledo Edison runs Autopositive intermediates at uniform, practical speeds in its direct-process machine . . . gets sharp prints time after time. *Autopositive lines do not smear, smudge, or lose density.*

☐ **Drafting shortcuts.** An Autopositive print is made of a drawing which has to be altered. The obsolete detail is eradicated or scissored out, and another Autopositive is made. New design is then added, and the job is completed without redrafting.

☐ **Photo-lasting file copies.** Toledo Edison also finds that Autopositive intermediates will not turn yellow or become brittle . . . are ready to produce sharp, legible prints whenever needed.

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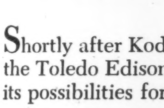


Shows all the ways you can save with Kodagraph Autopositive Paper.

(*Continued from page 88*)

Some of the factors which must be considered in maintaining a reproducible arrangement are highly significant in the development of absolute measurement techniques. The results recorded by a detector generally constitute only a fraction of the total number of emissions produced by the sample. The relationship between the actual *disintegration* rate of a sample and the *counting* rate indicated by a laboratory instrument is a function of several factors. Discounting the efficiency of the particular detector for the radiations in question, there are three effects which significantly change the overall efficiency of any counting arrangement: (1) geometry of the sample and detector, (2) absorption, and (3) scattering.

The prime and most apparent factor affecting the efficiency of any counting arrangement is the position of the sample relative to the sensitive volume of the detector. Since sources radiate equally in all directions (ignoring, for the moment, the scattering effects of source support structures), the geometry increases as the detector subtends a larger portion of the solid angle about the source. In the case of an end-window counter tube, the geometry in common use may give an efficiency ranging from 1 to 30 percent depending upon the distance from the sample to the sensitive volume. In the case of an internal counter, where the sample forms a portion of one wall of the counting chamber, the geometry is 2π (50 percent of the solid angle).

Scattering of the radiations by the source and its supports can have a significant effect on counting efficiency. Usually the most important of the several scattering actions is "backscatter"—the reflection back into the sensitive volume by the source support (sample pan) of radiations originally emitted by the sample away from the sensitive volume. This has the effect of increasing the counting rate over that of the same sample suspended freely in air. Scattering is a function of a number of variables: the type and energy of the radiation, the atomic number of the material from which the sample pan is made, the pan thickness and the incident and reflection angles. The amount of backscatter increases with the energy, atomic number, and thickness of scatter. Counting rates may be increased as much as 60 percent by pans made of silver or platinum. Scattering which takes place from other portions of the detector-sample mounting is usually minor compared to backscatter and is relatively constant for one instrument.

N*G*Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"Don't look at me, Professor," begged Joe Kerr. "Just this once, wont you call on Cal first?"

"I'll bet he couldn't do it," taunted Cal Klater. "Make him admit he didn't find Marilyn's diameter."

"Trouble, Joe?" asked Guest Professor Nagle gently.

"Lots, but it gives me a good alibi. I started working the problem with one eye on the TV and Fay (that's my wife) asked me what I was doing and I quipped that I was figuring Marilyn's diameter. She snapped off the TV and tore up my paper, and I kidded her for being jealous of an asteroid instead of a TV star. The last straw was when she read in the dictionary that an asteroid was a small body resembling a star, and what she said isn't anybody's business, but it took until midnight when I promised all sorts of things. That's my alibi, but it was also a clue to a conclusion that the problem can't be solved without making unreasonable assumptions."

"My, my, my, what a woman Fay Kerr must be," snorted Cal. My only assumption—no refraction—is reasonable for a small asteroid with little or no atmosphere. Then, if each of 4 space ships saw the other 3 on the asteroidal horizon, the 6 lines of sight are tangent to the sphere. Designating the ships A, B, C and D and their tangent distances a, b, c and d respectively, we are given:

$$a + b = 15, a + c = 17, a + d = 24$$

$$b + c \text{ or } b + d \text{ or } c + d = 8$$

Since all are positive, $a < 15$, so that $d > 9$ and only $b + c = 8$, which determines $a = 12$, $b = 3$, $c = 5$ and $d = 12$. The tetrahedron could now be drawn, but the development (Fig. 1) tells the story better. Of the 4 faces, 2 are isosceles and 2 right triangles, making plane ABD perpendicular to BCD. From the radii of the inscribed circles, which are sections of the sphere, its center must be 3 sonameters from ABD and 4 sonameters from BCD, so that its radius is 5 and the required diameter of Marilyn is 10 sonameters."

"Nicely and neatly done," said Guest Professor Stoop Nagle, "but only because I was merciful. Without the right triangles you would have been led to a quartic, and without the isosceles triangles, to an octic. Now Joe, what assumption was unreasonable?"

"You didn't call Marilyn spherical. When it took an encyclopedia to prove my innocence to Fay, I learned that the smaller the asteroid the rougher the shape."

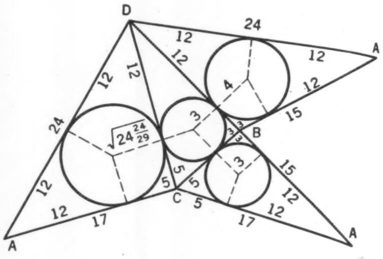


Fig. 1. The development of tetrahedron ABCD on plane BCD shows Marilyn in circular sections.

"I think from its name this one must have been well rounded," said Professor Neare," but Professor Jenney claims there is one flat spot which is a good setting for a new problem."

"The setting," echoed Professor Jenney, "is the only diamond on this Marilyn—Diamond Field, named for its shape. When one space ship ventured too close, it was purged with one burst at ranges of 30, 31, 32, and 33 marilymeters, respectively, from guns at the 4 corners. If the fence surrounding the fields had its posts one marilymeter apart, how many were there?"

[*Cal Klaters were Richard Jenney, S. K. Ruebell* (*Keith Jones*), *Thatchrite* (*Guy C. Thatcher*), *Ed C. Holt, Jr., Henry W. Troelsch, Don' T* (*Don Thayer*), *and Sauer Doe* (*Marvin Larson*), *plus another for February, John F. Oyler, whose Nippon address is an alibi. Guest professors were John L. Nagle and Richard Jenney*].

New Jersey Turnpike Is Being Widened

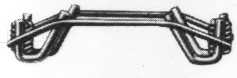
Award of three contracts totaling $15,002,376 for widening the four-lane sections of the New Jersey Turnpike to six lanes, between the George Washington Bridge interchange and the North Camden-Philadelphia interchange, is announced by Paul L. Troast, chairman of the Turnpike Authority. These awards went to S. J. Groves & Sons Company and the Reid Contracting Company, of Woodbridge, N.J., and the Union Building and Construction Company, of Passaic, N.J.

Work on the widening has already begun, and completion is scheduled for the end of the year.

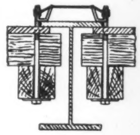
5 SUPERIOR WAYS OF HANGING FORMS FROM STEEL BEAMS AND GIRDERS

(NOT FIREPROOFED)

Especially designed to meet field conditions on BRIDGE SUPERSTRUCTURES



Standard Coil Hanger Frame



When hanging forms where specifications do not permit any hanger wire to be exposed after stripping, use Superior *Standard* Hanger Frames. Detail at left shows their use with double ledgers, 1/2″ coil bolts, and flat washers. Total safe load on both bolts is 10,000 lbs., or 5,000 lbs. per bolt.

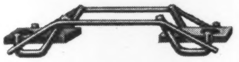
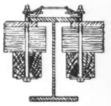
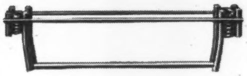


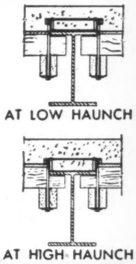
Plate Hanger Frame



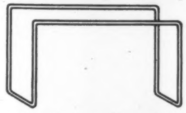
The Plate Hanger Frame, shown at left, has metal plates with a punched hole instead of wire coils. The Coil Bolts are passed through the holes and secured from above with coil nuts. The plates provide adequate bearing for the nuts, which being square will not turn when the bolt is removed. The installation and necessary adjustment to bring the deck forms tight against the flange are from above the deck. The total safe load on both coil bolts is 10,000 lbs., or 5,000 lbs. per bolt.



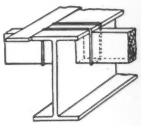
Special Hanger Frame



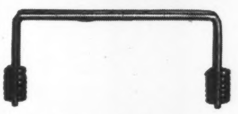
The design of certain bridge superstructures allows for the permanent deflection of the beams or girders due to the pre-calculated dead load. This deflection is compensated by a concrete haunch on the upper flange, which varies in depth. Superior *Special* Coil Hanger Frames were developed to meet this field condition, at the same time avoiding any exposed hanger wire. The extent to which the 1/2″ Coil Bolts are threaded into the coils allows for these varying haunch depths from maximum to zero. (See detail at left.) Total safe load per frame is 10,000 lbs., or 5,000 lbs. per 1/2″ bolt .



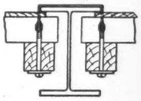
Wire Beam Saddle



Wire Beam Saddles are used to hang centering joists from structural steel beams when the beams are not fireproofed with concrete. On non-fireproofed structures the load is determined by the allowable spacing of centering joists rather than the capacity of the hanger. Available in three gauges and sizes as required. Will carry safely, total loads of 2,500 lbs. to 6,000 lbs. Layouts and estimates will be sent upon receipt of plans or quantities. No obligation.



Coil Beam Saddle



Superior Coil Beam Saddles are used, as shown at left, where hanger wires may be cut after stripping the forms. The Coil Bolts allow for any variation in lumber and flange thickness and tightening the bolts pulls the forms tightly against the flanges. Forms are easily stripped. Safe load is 6,000 lbs. per saddle, or 3,000 lbs. for each 1/2″ Coil Bolt. Coil Beam Saddles are also furnished for 3/4″ and 1″ bolts.

WORKING PARTS (Bolts and washers) are returnable. Layouts and estimates for Superior Hangers are available without obligation.

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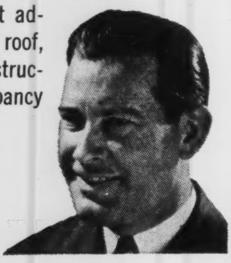

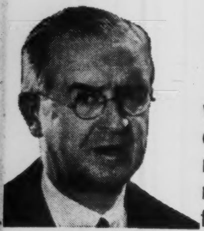

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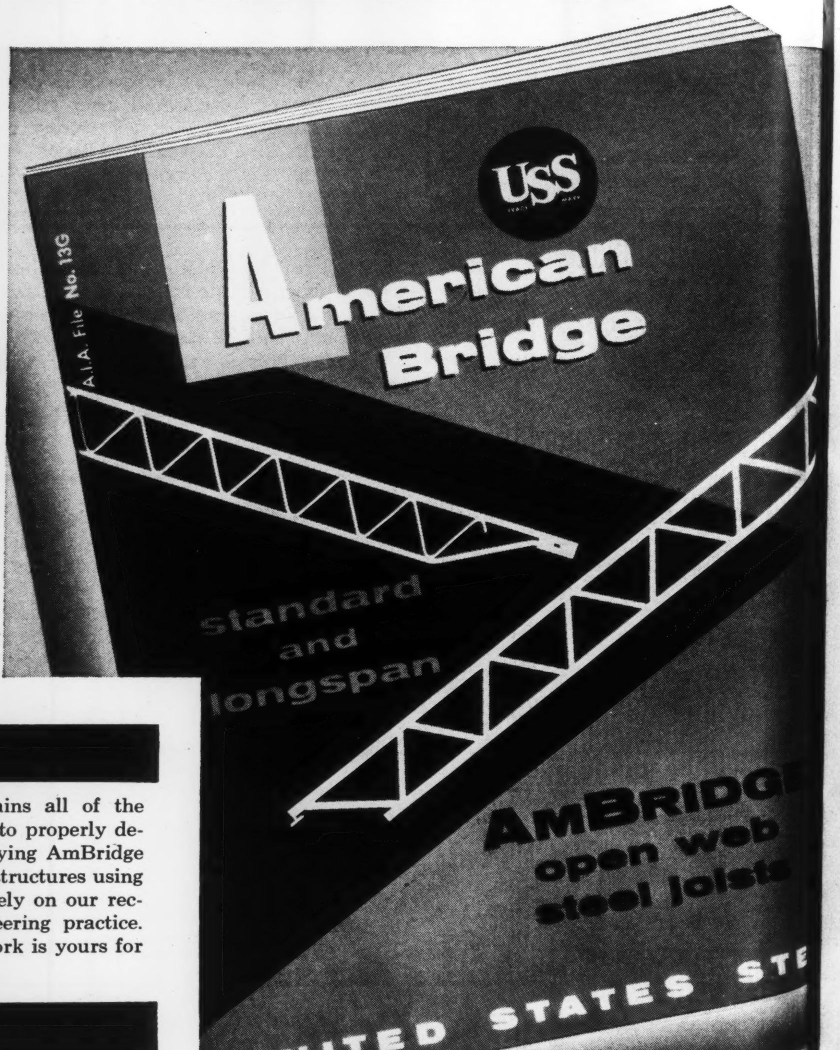

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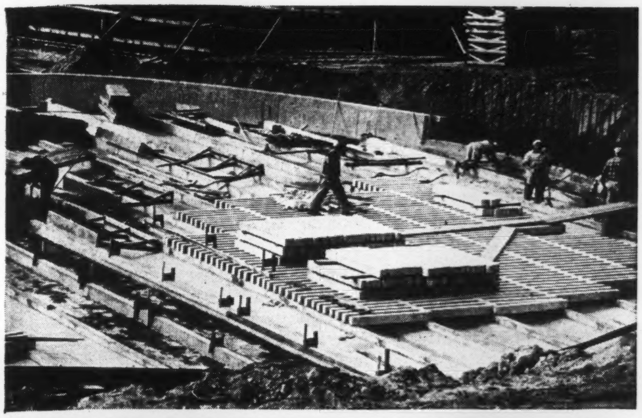
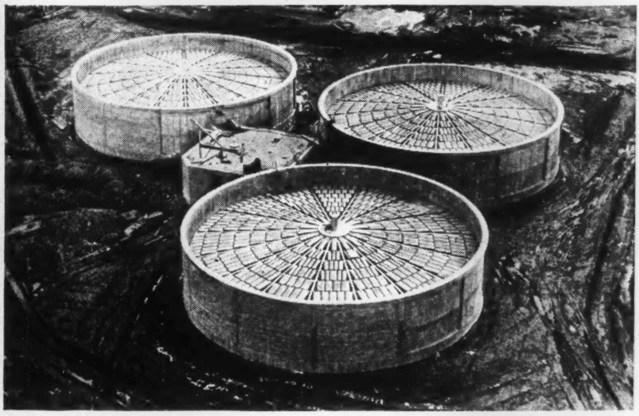
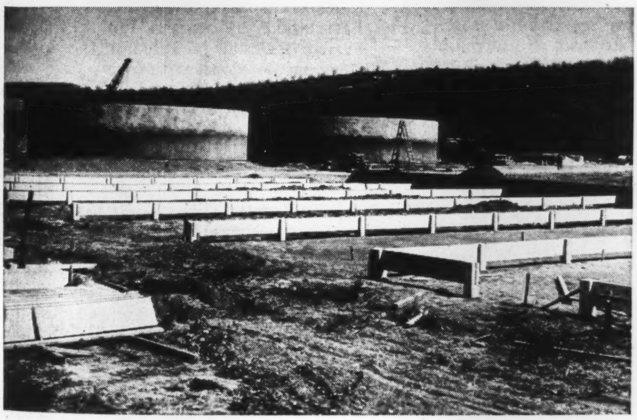
AMBRIDGE STEEL JOISTS

UNITED STATES STEEL







Precast
CONCRETE UNITS

offer many advantages for Modern Sewage Treatment Works

Precast concrete units are being used more and more in sewage treatment plant facilities. There's a good reason. Precast concrete units offer all the advantages of conventional concrete construction—plus speed, economy and easy handling. Here are typical recent examples:

FILTER UNDERDRAINS of the six trickling filters in the East Providence, R. I. Sewage Treatment Plant are precast, reinforced concrete beams (top photo). Because of concrete's great strength they could be used as cribbing to support the weight of the crushed traprock filter medium.

DIGESTER COVERS in the East Providence plant (second photo) are 2-in.-thick, tongue-and-groove precast concrete planks. Since concrete resists rot in a damp atmosphere, it was chosen over less durable materials.

Covers for the digester tanks of the Benton Harbor-St. Joseph, Mich. Sewage Treatment Plant (third photo) are short slabs of precast concrete that rest on purlins connecting radial girders. Crevices between slabs are calked with mastic. Triangular spaces between slabs and girders are filled with grout. Covers are 80 ft. in dia., rise 3 ft. from the outer edge to the center.

SLUDGE BED PLANKS AND POSTS in Elmira, N. Y. Sewage Treatment Plant are precast concrete units (bottom photo), part of a million-dollar plant addition. Durable precast concrete units can withstand a lifetime of weathering and freeze-thaw cycles in such installations.

Precast concrete construction is moderate in first cost, requires little maintenance, serves for years. The result is ***low annual cost,*** the real measure of the economy of any construction.

For more information, write for a free illustrated booklet, *"Sewage Treatment Works."* It is distributed only in the United States and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. AS-13, 33 West Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work

DECEASED

Frank Leroy Brown (M. '50), age 73, consulting engineer of San Clemente, Calif., died on February 13. During his long career Mr. Brown was engaged in consulting engineering and was employed as structural designer for the St. Louis, Mo., Division of Bridges and Buildings and the Division of Building and Inspection. Mr. Brown graduated from Iowa State College in 1904.

Henry Diedrich Bruning (M. '22), age 79, consulting engineer of Columbus, Ohio, died on February 26. Following graduation from Ohio State University in 1896 Mr. Bruning was engaged in railroad work and from 1905 to 1911 had a private practice. From 1912 to 1923 he was consulting engineer for the Ohio Paving Brick Manufacturers Association and division and chief engineer with the Ohio State Highway Department. In the thirties he served as vice-president and then president of the Hocking Valley Brick Co. of Columbus.

Percy Hiram Budd (A.M. '15), age 69, since 1953 flood control engineer for the Orange County (California) Flood Control District, died on February 8 in Santa Ana. A 1908 graduate of Cornell University, Mr. Budd was employed by the Department of the State Engineer and Surveyor of New York for many years during the construction of the Barge Canal and Terminals. In 1923 he became assistant engineer for Walter G. Clark, consulting engineer of New York and Los Angeles making developmental studies of the Colorado River. In 1934 Mr. Budd joined the Orange County Flood Control District and in 1949 was appointed assistant flood control engineer.

Joe Beaty Butler (M. '29), age 59, professor and chairman of the Civil Engineering Department at the Missouri School of Mines, Rolla, Mo., died in a St. Louis hospital on March 27. Professor Butler was a 1915 graduate of Oklahoma A. & M. College and received his C.E. and Masters' degrees from the Missouri School of Mines, where he went as an instructor in 1920. In 1923 he became associate professor and was made chairman of the department in 1931. Long active in professional organizations, Professor Butler had been president of the Society's Mid-Missouri Section and at the time of his death was a national director of NSPE. He played a leading part in preparing Missouri's engineer-architect licensing law and commission.

Harry Carman Coons (M. '39), age, 68, deputy commissioner and chief engineer of the Michigan State Highway Department, Lansing, died on February 16. A graduate of the University of Michigan, class of 1916, Mr. Coons joined the Highway Department in 1919 as a resident engineer and was promoted in 1920 to assistant district road and bridge engineer. From 1922 to 1933 he was a member of the road construction firm, Hudson & Coons, and then became deputy commissioner. Mr. Coons helped found and was secretary-treasurer of the Michigan Road Builder's Association.

Edward Meyer Dycker (A.M. '26), age 59, surveyor for the Nuanetsi Ranch, Ltd., Nuanetsi, Southern Rhodesia, South Africa, was killed in a hunting expedition there on January 27. Born in Norway and educated at the Norges Tekniske Hoiskole, Mr. Dycker came to the United States in 1924 to work for the Stearns-Roger Manufacturing Company. He was with various companies in the United States and Chile. Much of his career was spent in the Near East where he worked for the Trans-Persian Railroad in Teheran, the Société Génerale de Constructions en Iran, and the British State Railroads in Iran. During the war Mr. Dycker was a major in the Norwegian Army stationed in England.

John Kramer Flick (M. '19), age 70, for the past twenty-five years highway engineer for the Inter-American Highway with headquarters at San Jose, Costa Rica, died on March 19. Mr. Flick was a member of the firm, Farmer and Flick, in Baltimore before starting his own firm in Sudlersville, Md., in 1921. Until his retirement last November he was employed

(*Continued on page 96*)

ALL PITS ARE DIFFERENT....

3-cu. yd. rapid shifter

THAT'S WHY
SAUERMAN SCRAPER MACHINES ARE JOB-ENGINEERED FOR YOUR PLANT

Your deposit may require a manually-shifted tail and bridle system or it may need a rapid shifter to make the many moves necessary in shallow pit operation or handling of non-caving material. If large capacities and long hauls are involved, a Sauerman Track Cable machine may best suit your needs. In the latter arrangement, the scraper bucket is attached by chains to a carrier traveling on a track cable. The bucket conveys its load at ground level and is discharged at the dumping point by merely tightening the track cable. Bucket and carrier glide back to the digging point at high speed when brake is released.

Sauerman scrapers work equally well on hills, boggy ground or in deep water. One man controls digging, hauling and dumping from a safe location, which may be as much as 1,000 ft. from the deposit. Sauerman machines cost less than any other types of excavators of similar capacities. Operating costs are very low, because you eliminate the power cost involved in moving heavy machinery around the area. A drag scraper maintains its efficiency for many years. When parts are replaced—sheaves, clutch or brake linings—the machine is restored to practically new condition, even though it may be twenty or more years old.

Write to Sauerman's experienced engineers about your plant

They will give you specific recommendations without obligation. Request Catalog A, Drag Scrapers—24 pages of job photos and specifications.

SAUERMAN BROS. INC.
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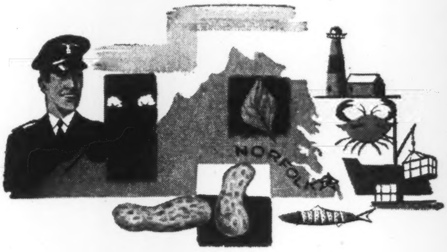
Norfolk Prefers Concrete Pressure Pipe



Since 1921, Norfolk, Virginia, has been specifying concrete pressure pipe for its water supply and distribution system. Over 450,000 feet of pipe is now in use. Diameters range from 20″ to 48″.

Still in excellent condition is the 31,700 feet of concrete pressure pipe laid in 1921. There has been no necessity to take this pipeline out of service for any maintenance work; nor has the pipeline suffered from any trouble due to electrolytic action. This pipe is now carrying water at the same high capacity as when it was installed.

If your city wants pipe with an assured high-carrying capacity, decade after decade . . . if long term economy is a necessity . . . then look into the advantages of concrete pressure pipe when you plan your next transmission or distribution lines.

Member companies manufacture
concrete pressure pipe
in accordance with
nationally recognized specifications

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AMERICAN CONCRETE
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Chicago 1, Illinois

HOW TO HANDLE WET JOBS

BRIDGE PIER COFFERDAM

Winona, Minn.

Contractor: James Construction Co.

BEFORE DEWATERING. Earth cofferdam is shown around damaged and tilted center pier of bridge which had been washed away by Mississippi Spring floods. Griffin Wellpoint system (see photo, right) has 640-ft perimeter.

WITHIN 12 HRS, the 2 pumps have brought water below subgrade, wresting 5000 gal per min from the very coarse sand and gravel.

IN INSTALLATION, the wellpoints on this job had to be driven the last few feet, through gravel. Fortunately, Griffin's is the only point specifically designed for driving as well as jetting. Contractor was thus enabled to "breeze through" what might otherwise have proved a big headache.

GRIFFIN WELLPOINT CORP.

381 East 141st Street, New York 54, N. Y.
Hammond, Ind. Houston, Tex. Jacksonville, Fla.

In Canada: Construction Equipment Co., Ltd.
Toronto Montreal Halifax

Deceased

(Continued from page 94)

in the regional office of the Inter-American Highway in Central America and Panama. He was one of the pioneer group of engineers who built the famous Madeira Mamore Railroad up the Amazon River in Brazil early in the century.

James Nickerson Gladding (M. '17), age 75, of Fontana, Calif., died on January 31. A 1906 graduate of Massachusetts Institute of Technology, Mr. Gladding held various municipal and government positions, including city engineer of Albuquerque, N. Mex., from 1906 to 1915 and city manager from 1920 to 1922 and again in the thirties. He had been engineer inspector, traveling engineer, and engineer-examiner for the PWA, and during the war was in Washington, D.C., with the Governmental Division of the War Production Board. In 1947 he organized the firm of E. F. Gladding Company, general contractors, in Fontana, Calif.

Charles Radcliffe Haile (M. '32), age 65, owner of Charles R. Haile and Associates, Houston, Tex., died on March 2. A graduate of Texas A. & M. College, class of 1912, Mr. Haile did work outside the United States until 1917, when he entered the Army Corps of Engineers. After the war he became highway engineer for Kleburg County in Texas. Later he was a superintendent for the Texas Highway Department on federal aid projects, and from 1922 to 1937 was engineer for Harris County. Mr. Haile was senior partner of Haile & McClendon from 1941 to 1946 when he started his own firm.

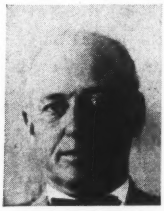
Louis Wells Hall (M. '13), age 82, of Evanston, Ill., died on December 5, 1954, at Talladega, Ala. Actively engaged in engineering for sixty-five years, Mr. Hall started his career with the Solvay Process Company in 1888. In 1894 he started work in railroad construction and from 1900 to 1912 was with the U.S. Reclamation service (now the Bureau of Reclamation) on the design and construction of high dams and gates. Before and after World War I he was engaged in hydroelectric design. In 1925 he was appointed by the Sanitary District of Chicago to head the hydraulic department, a position he held until his retirement in May 1954.

Paul Vincent Hodges (M. '40), age 71, since 1946 hydraulic engineer with the Army Corps of Engineers in the Denver District, died on February 25. Mr. Hodges received a B.S. degree from the University of Wisconsin in 1909 and a C.E. degree there in 1924. He was with the U.S. Geological Survey in Portland and Denver from 1914 to 1931, and made studies and reports for the U.S. Indian Irrigation Service the following ten years. He had been in the Corps of Engineers since 1942—first on studies of Denison Dam in Texas and then in the Omaha District before going to Denver.

Theodore Human, Jr. (A.M. '18), age 74, one of the survivers of the construction corps of the Madeira-Mamore Railroad in the Amazon Valley (1909–1910) died in San Francisco on March 29. From 1910 to 1921 Mr. Human worked on railroad construction in Central and South America, and from 1927 to 1930 he was in Bogota doing reports for the Colombian Government and the Venezuela Petroleum Co. in Venezuela. During the war he was principal engineer for the U.S. Engineering Department in the Pan American and Miami District. He had also been in this country town engineer and superintendent of Public Works for Teaneck Township, N.J. (1921–1927), and for seven years was with the U.S. Coast and Geodetic Survey (1930–1937). Most recently Mr. Human was project highway engineer in the Okinawa Engineering Division of Skidmore, Owings & Merrill.

William Balfour Ivie (A.M. '47), age 54, construction management engineer in the South Pacific Division of the Corps of Engineers, San Francisco, died on March 13. Before joining the U.S. Engineer Office in St. Louis in 1933 as a concrete technician, Mr. Ivie worked for various companies as construction engineer. In 1939 he was transferred to the U.S. Engineer Office in Little Rock, Ark. In 1947 he was made chief of the Field Investigation Branch in the Western Ocean Division. Mr. Ivie was a resident of San Rafael, Calif.

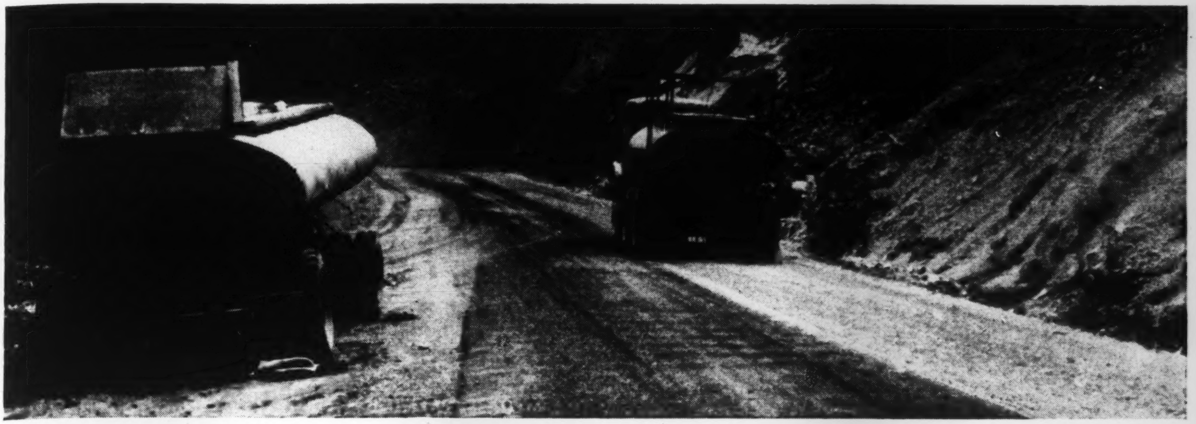
John Hays Myers (M. '18), age 85, retired civil engineer of the New York City Board of Transportation, died in White Plains on March 29. A graduate of Rensselaer Polytechnic Institute, class of 1890, Mr. Myers spent forty years in the service of New York City—six in the water works department of the City and Borough of Brooklyn and thirty-four on the construction of the City's transit system. As assistant, senior assistant and, after 1906, division engineer of the department, he supervised a considerable portion of this system. Mr. Myers retired in 1934.



W. B. Saunders

Walter B. Saunders (M. '13), age 73, retired civil engineer of Southern Pines, N.C., died on February 4. After graduation from the University of Wisconsin in 1903, Mr. Saunders spent six years on telephone-conduit construction in Utah and Michigan. Later he was with the U.S. Reclamation Service and various power companies in the west. In 1925 he joined the Andes Copper Mining Company as hydraulic engineer, later becoming chief hydraulic engineer. He lived in Chile from 1925 until 1950. In 1933 Mr. Saunders was awarded the Society's James

(Continued on page 98)



WATER-WAGONS like those shown here, a blade grader and a roller were the only pieces of equipment needed to maintain good, stable haulroads by the Diluted Bitumuls Base Treatment method.

Simplified Bitumuls Base Treatment Slashes Cost on Heavy Duty Haul Roads

West Coast Logging Firm Benefits from Use of Diluted Bitumuls®

One of the toughest jobs a road builder faces is maintaining haul or access roads for heavily loaded vehicles at a ton-mile cost compatible with available funds and within the scope of equipment on hand.

Costs Down 50%

One West Coast logging company now believes it has an answer to this difficult problem. Last year, they used what is known as the "Diluted Bitumuls Base Treatment." This has not only increased the serviceability of these roads, but has also actually cut their costs more than 50% below that of the previous best method used.

Previous Methods

Back in 1950 this company used an asphalt cut-back with 10% Diesel oil added, at a cost of $620.00 per mile. Cost prohibited the application of aggregate cover and considerable pickup and raveling under traffic resulted. Three months of penetration patching with Bitumuls emulsified asphalt was required to keep this road in operation. No costs were kept on this maintenance work.

In 1951 a heavier application of the cut-back Diesel mixture was used, at a cost of $650.00 per mile. A ¾ inch application of ⅛″ crushed rock was placed at certain sections where pickup and raveling was severe. Patching was again required to maintain this road under the tough traffic conditions.

In 1952 the company tried using hot applied fuel oil and the same type of aggregate cover. This combination gave longer, trouble-free wear, but the cost was still higher (nearly $1,000 per mile).

Diluted Bitumuls Treatment

In both 1953 and 1954, a mixture of 10% Bitumuls SS-1 and 90% water was used at 1200 gallons per mile in three applications of 400 gallons each. *Total cost of this treatment was $294.00 per mile.* Observations after two years have indicated that the base established by this treatment required no aggregate cover and did not pick up or ravel under traffic. Dust, which formerly constituted a real hazard, was held to a minimum, and when it did occur was of a heavy and quick-settling type.

Many old timers will tell you that the Diluted Bitumuls Base Treatment is not new. It has been used in other parts of the country under various names, but the methods employed are much the same. All that is required is a water wagon, a mixing blade, (or motor patrol) and a roller. Material is windrowed; the diluted Bitumuls applied by sprinkler trucks and then mixed, spread and compacted. After compaction the road can be opened to traffic.

Full information on the Diluted Bitumuls Base Treatment and on other types of Bitumuls construction can be obtained by calling our nearest office.

WATER-WAGON applies Diluted Bitumuls to base material.

BLADE GRADER is used for mixing and spreading ahead of compaction.

THREE-WHEEL ROLLER compacts base to a smooth, dense finish.

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Naylor pipe is the perfect vehicle whenever a construction job calls for moving sand, gravel and water. Though light in weight, this distinctive lockseamed, spiralwelded pipe has the extra strength, leaktightness and safety that make it outstanding in dredging service. It's easy to handle, install and knock down—especially when used with Naylor one-piece Wedge-Lock couplings. For full details on Naylor pipe, fittings and couplings, write for Bulletin No. 507.

NAYLOR PIPE

NAYLOR PIPE COMPANY

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Deceased

(Continued from page 96)

Laurie Prize for his paper on the construction of the La Ola pipe line.

Irwin H. Schram (M. '48), age 66, chief engineer of the Erie Railroad in Cleveland, Ohio, died on January 28. Mr. Schram joined the Erie Railroad in 1908 after graduation from the Armour Institute of Technology. In 1921 he was made regional engineer and since then had been district engineer, chief engineer of maintenance of way, and since 1946 chief engineer.

Henry T. Shelley (M. '14), age 87, vice-chairman of the Delaware River Joint Toll Bridge Commission, died at his home in Milford, N.J. on April 2. During his early career Mr. Shelly worked for numerous railroad companies until 1907 when he became assistant engineer for the City of Philadelphia. He retired as city engineer in 1921 and became secretary-manager of Eastern Clay Products Association, Pittsburgh, Pa. Mr. Shelley served four terms as Mayor of Milford.

Nathan L. Smith (M. '41), age 66, director of the Maryland Public Works Department since 1951, died in Baltimore on February 4. Mr. Smith worked for the state of Maryland and city and county of Baltimore from 1921 until his death. He had been highway engineer, associate engineer for the city, chief engineer of the State Roads Commission, state director of Public Works, and chief engineer of Baltimore County. Mr. Smith graduated from Swarthmore College in 1908 and received a C.E. degree there in 1921.

Harold N. Sutton (A.M. '42), age 63, chief of safety inspection for the City of Charlotte, N.C., died on March 5. Mr. Sutton was employed as office engineer and assistant to the state highway engineer of the South Carolina State Highway Department and later was in the Atlanta office of the Portland Cement Association. From 1933 until his death he worked for the City of Charlotte. During this time he served the city's Park & Recreation Commission as engineer and was later resident engineer.

William D. Waltman (M. '11), age 80, mining engineer and corporation executive of Los Angeles, died on February 14. Following graduation from the Colorado School of Mines in 1899, Mr. Waltman became principal assistant city engineer for Colorado Springs. He then spent five years as superintendent of mining and construction on the Panama Canal for which he was awarded the Theodore Roosevelt Panama Medal. From 1912 until his retirement in 1948 Mr. Waltman was with the Franco Wyoming Oil Company at Salt Creek Field, Wyo., serving as superintendent of field operations, vice-president, general manager, and director of the company. Mr. Waltman was also

(Continued on page 102)

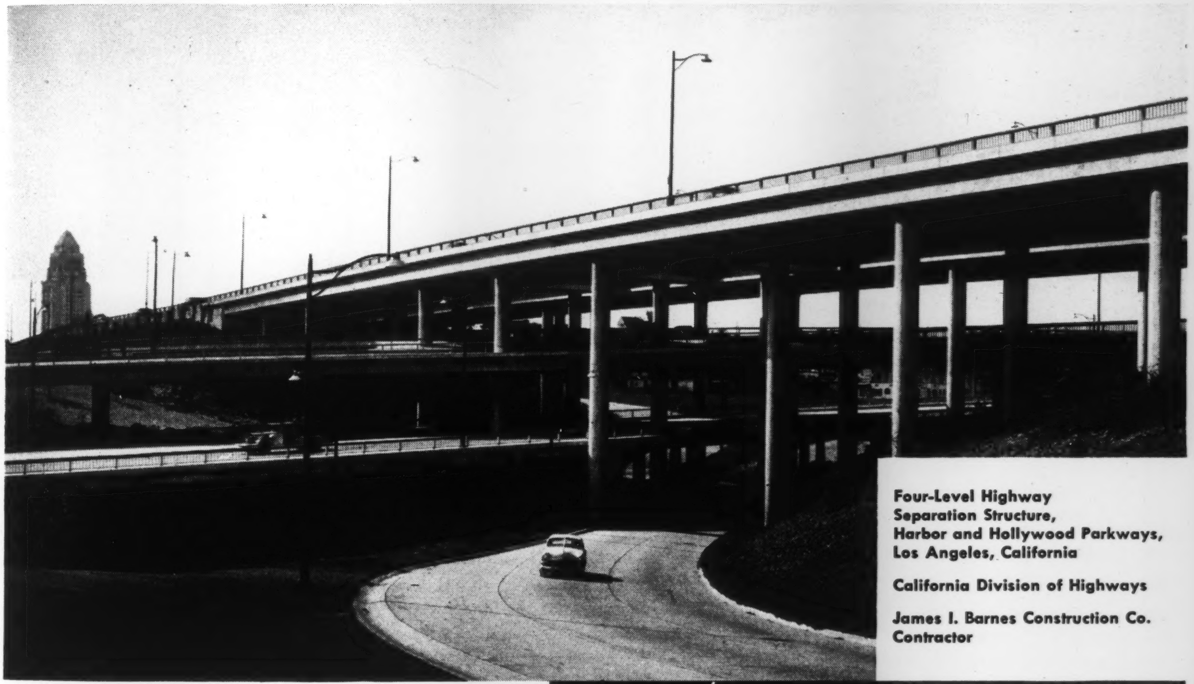
Your appropriation dollars will go further when you design your bridges for reinforced concrete. And, this flexible medium permits a more imaginative approach to bridge design. Bridges with bold, dramatic lines and shadow . . . bridges with soaring curves and a light, airy touch . . . both are possible with reinforced concrete.

Structures built with reinforced concrete are rugged, too . . . highly resistant to wind, shock, and quake. They are more weather resistant, and require less maintenance. Furthermore, materials and labor are readily available from local sources.

On your next bridge, overpass, or grade separation job . . . design for reinforced concrete.

WORLD'S FIRST 4-level grade separation

built with REINFORCED CONCRETE

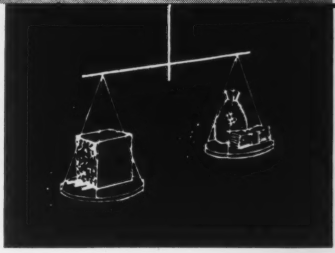


Four-Level Highway Separation Structure, Harbor and Hollywood Parkways, Los Angeles, California

California Division of Highways

James I. Barnes Construction Co. Contractor

Courtesy, Portland Cement Association



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As a result of long-range planning and solid growth, Boeing now employs nearly twice as many graduate engineers as at the peak of World War II. These members of aviation's most respected design and research group developed the B-47 and B-52 jet bombers, the IM-99 guided missile, and America's first jet tanker-transport. New and widely diversified projects are under way: supersonic flight, research in rocket, ram jet and nuclear propulsion, guided missile control, and much more.

Boeing engineers work with the most modern equipment, including electronic computers, chambers that simulate altitudes up to 100,000 feet, superb laboratories, and the multi-million-dollar new Flight Test Center.

With these advantages of facilities and opportunity for advancement, you can be sure of individual recognition at Boeing. Your achievements as a member of a tightly knit design or project "team" are recognized by regular merit reviews, and by Boeing's policy of promoting from within the organization.

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Aviation leadership since 1916

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Unique use of LACLEDE STEEL JOISTS

saves building time and cost for new Missouri high school

PACIFIC HIGH SCHOOL
Pacific, Mo.
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Juengel Construction Co.,
St. Louis
Architect:
Charles Lorenz,
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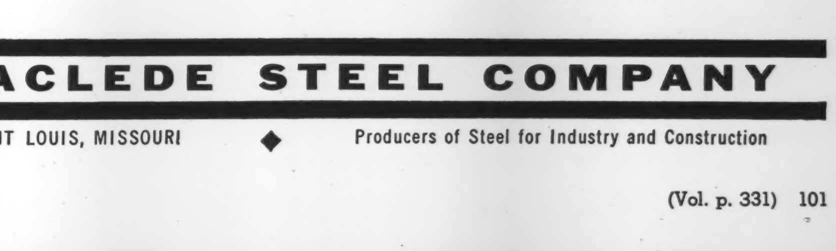
The new Pacific High School provides an excellent demonstration of the versatility of Laclede Straight Chord Steel Joists and their adaptability to specific architectural requirements.

By using two single joists with cantilever extended ends on each side of a three bay roof design, the number of joists required on the project was reduced by one-third and substantial saving resulted in material, time and labor.

Other Laclede Steels, too, including Multi-Rib Reinforcing Bars and Welded Wire Fabric, were used in this modern new building.



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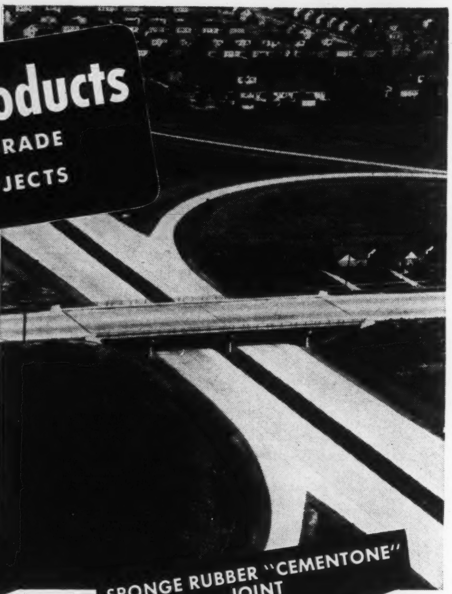

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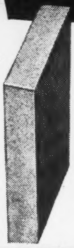
Concrete bridge and grade separation structures are subject to unusual amounts of movement due to temperature change, traffic stresses, and settling simply because they have to be built "up in the air." The following are a few of the Servicised Products which you can specify or use which will take this movement and yet keep your job sealed against moisture and attractive in appearance.

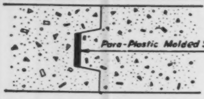
CORK and SELF-EXPANDING CORK JOINT FILLERS

Both types are non-extruding resilient and compressible, inconspicuous in color. Cork recovers 95% original thickness after compression; Self-Expanding Cork is treated to expand 50% beyond original thickness to keep joint filled regardless of contraction movement.

SPONGE RUBBER "CEMENTONE" JOINT FILLER

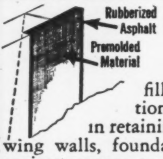


Fully resilient high quality blown sponge rubber "Cementone" blends with color of concrete. Uniform thickness and density. Available in varying degrees of compressibility to meet your requirements.



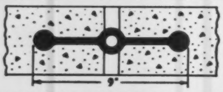
MOLDED PARA-PLASTIC

For sealing keyed construction or contraction joints in vertical walls. Maintains bond with concrete at temperatures down to sub-zero. Simple installation insures a resilient, moisture-tight seal of the joint.



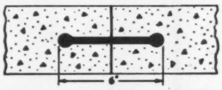
PARA-LATERAL STRIP

For sealing backfilled vertical construction or expansion joints in retaining walls, abutments, wing walls, foundations, tunnels, etc. against seepage to exposed side. Para-Plastic facing of strip insures permanent adhesion to concrete.



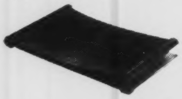
HOLLOW BULB RUBBER WATERSTOP

For permanent, watertight seals in expansion joints where a high degree of expansion and contraction is expected.



FLAT DUMBBELL TYPE

Flexible, elastic rubber with very high tensile strength for sealing construction joints.



SPLIT DUMBELL TYPE

Faster to install . . . eliminates split forms (1) Nail to bulkhead in form of a "T" (2) Section is poured and bulkhead stripped. (3) Divided section is joined together by stapling or with rubber cement.

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Servicised Mineral Surfaced or Standard Plank is resilient, quiet, long-wearing. Widely used on bridges, underpasses and grade separations as a wearing surface or as a waterproofing protection course.

Write for details on these Servicised Products and your copy of the complete catalog.

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Deceased

(*Continued from page 98*)

president and director of Azaco Inc., Franco Western and Franco Central Oil Co., and its Security Corporation. He was the first recipient of the Medal of Individual Merit and Honor given by the Colorado School of Mines.

Leon Vincent White (M. '43), age 72, retired professor of Civil Engineering, Kansas State College, Manhattan, Kans., died at his home on December 19, 1954. A graduate of Kansas State College, Professor White worked for the Santa Fe and Union Pacific railroads, and for the Chicago Sanitary District. For a short period he did private work as an irrigation engineer in Colorado. He started work at Kansas State College as an instructor in 1918 and continued this connection until his retirement, as a full professor, in 1952.

News of Engineers

(*Continued from page 25*)

August L. Ahlf is on loan from the chief engineer's office of the Bureau of Reclamation, Denver, Colo., to the Royal Irrigation Department of Thailand. He is completing his fourth year as chief designing engineer on the Chao Phya Project which will develop the agricultural and navigational potential of the Central Plain Area of Thailand. **Maneevana Salakshana** is head of the structural design section and **Kanok Pranich** is supervising engineer on the construction of a diversion dam and navigation lock across the Chao Phya River. **Albert W. Newcomer** is also a design engineer for the Royal Irrigation Department.

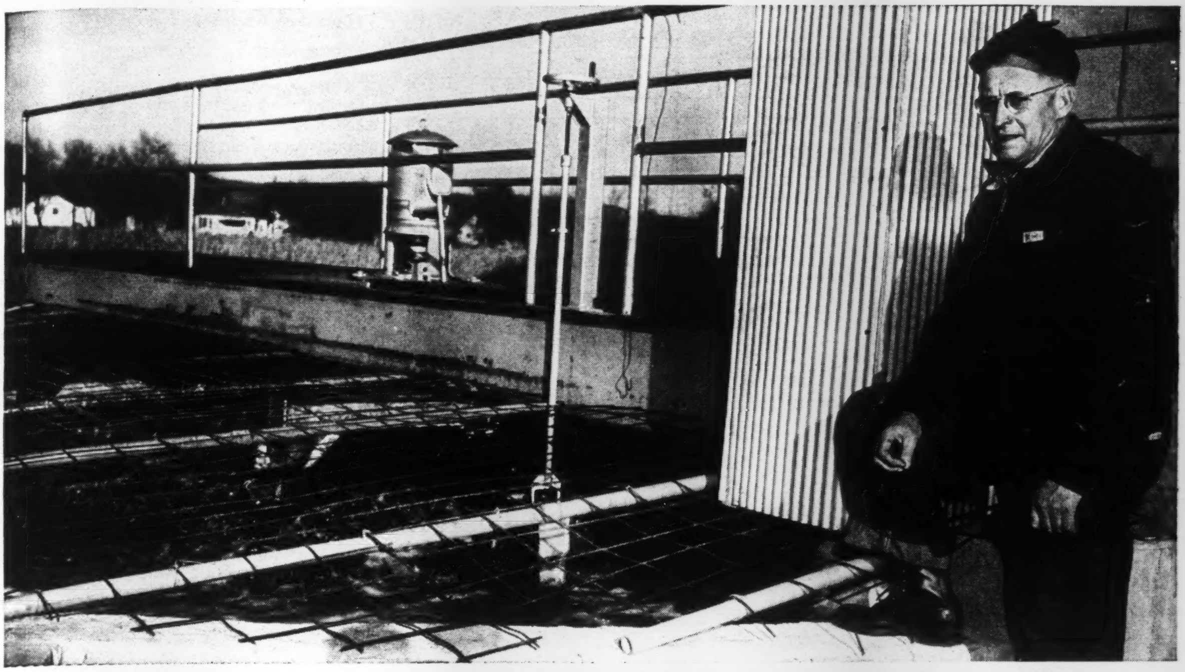
Newman E. Argraves became commissioner of the Connecticut State Highway Department on March 1. His experience includes engineering and construction work with Stone & Webster of Boston, and the Boston & Maine Railroad. Since 1944 he has been senior partner in Argraves and Associates in New Haven, Conn.

Edwin B. Cobb has been elected president of the Boston Society of Civil Engineers. Mr. Cobb is a partner in the Boston firm of Metcalf & Eddy.

D. Jackson Faustman, city traffic engineer for Sacramento, Calif., is on a four-month traffic survey assignment in Djakarta, Indonesia.

James C. Causey, Jr., is returning to his former job as city manager of Suffolk, Va., a position he held from 1941 until 1946. Mr. Causey is currently a partner of the firm of Causey and Weeks, Norfolk.

(*Continued on page 104*)



Mr. J. M. Bricker received the award at a recent meeting of the Nebraska Sewage and Industrial Wastes Association. Among other duties for the town of Paxton, Mr. Bricker spends about 12 hours per week looking after the 'Pakage' plant.

SCOTT-WILBUR

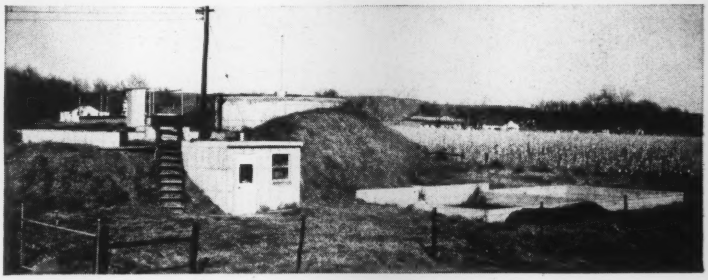
Award

"Sewage Plant Operator Having The Best Maintained And Operated Sewage Treatment Plant in Nebraska During 1954"

CHICAGO PUMP COMPANY'S

Activated Sludge 'Pakage'* Plant Performance Helps Win Coveted Award

* A trade mark of Chicago Pump Co.



Award Winning Sewage Treatment Plant, Paxton, Nebraska. Installation contains one 14′ combination Aerator-Clarifier unit. Plant capacity: 75,000 G.P.D., treating domestic sewage. Consulting Engineer: Ogallala Engineering Company. Constructed by Beal Construction Company.

Activated sludge 'Pakage' sewage treatment plants are specifically designed for small communities such as Paxton, Nebraska. They are not large plants scaled down.

The automatic features of the 14′ aerator and clarifier in the 'Pakage' plant at Paxton assure trouble-free performance while treating 75,000 G.P.D. of domestic sewage. 'Pakage' plants handle sewage flows from 15,000 to 500,000 G.P.D. in single or multiple units. The plant at Paxton is located near dwellings, like so many other Chicago 'Pakage' Plants, since they are clean, sanitary, and have no objectionable odors. Visitors are amazed at the crystal-clear effluent. In the past 21 years, Chicago 'Pakage' Plants have given trouble-free sewage treatment in over 230 installations.

For small communities, industrial plants and institutions, specify Chicago 'Pakage' Plants. Write Dept. K for complete engineering data and drawings.

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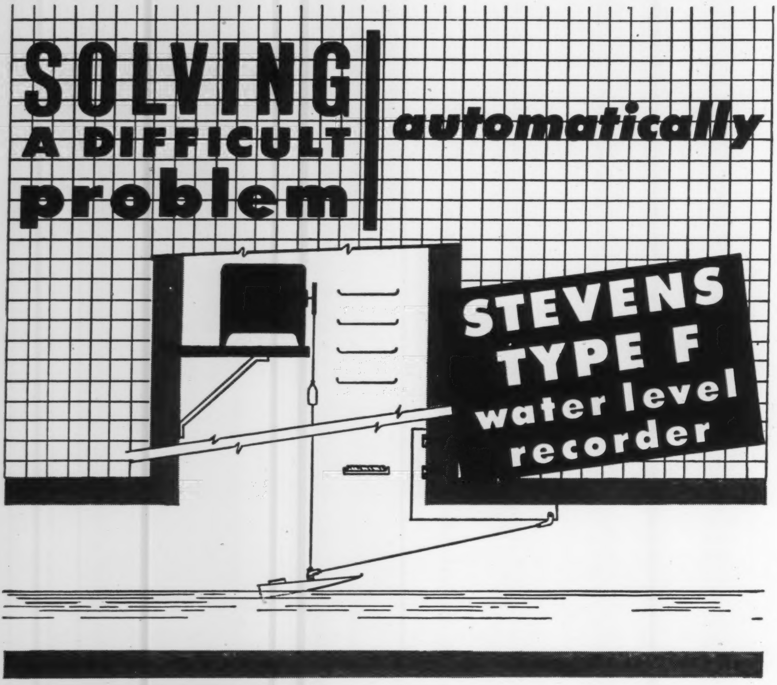
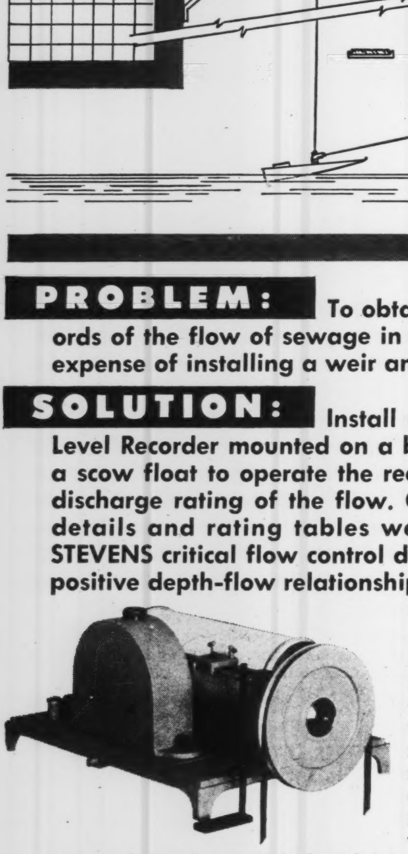

SOLVING A DIFFICULT problem
automatically
STEVENS TYPE F water level recorder

PROBLEM: To obtain automatic, graphic records of the flow of sewage in a sewer main without the expense of installing a weir and float well.

SOLUTION: Install a STEVENS Type F Water Level Recorder mounted on a bracket in a manhole. Use a scow float to operate the recorder and make a stage-discharge rating of the flow. Or, following construction details and rating tables we provide, also install a STEVENS critical flow control down stream to establish a positive depth-flow relationship.



The planning and efficient operation of any project which involves measurement of flowing liquids is based on flow data which can be obtained with STEVENS water level recorders. STEVENS instruments are at work compiling data on hydroelectric and flood control projects, and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

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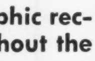

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News of Engineers

(*Continued from page 102*)

Harry William Nelson will be released in June from active duty in the Navy, with which he has been assigned to a construction batallion in Korea. He will return to the State University of Iowa for graduate work in sanitary engineering.

George R. Roy, planning technician of the New York Port Authority, was promoted March 1 to assistant highway planning engineer in the port development program. Mr. Roy joined the Authority in 1952 as a junior professional assistant trainee.

Alfred Gordon, formerly engineer with the bridge department of the Canadian Pacific Railway, Montreal, Canada, is now in the structural division of the St. Lawrence Seaway Authority, with headquarters in Montreal.

David J. Bauer, formerly on the field staff of the Chicago Public Administration Service, recently took the post of borough manager of Lititz, Pa. Mr. Bauer graduated from Syracuse University in 1948 and did post-graduate study at the Maxwell School.

Edward Arthur Bell has resigned as borough engineer and water superintendent of Essex Fells, N.J., to become chief engineer of the Stamford Water Co., Stamford, Conn.

Harry E. Newell, for many years assistant chief engineer of the National Board of Fire Underwriters, New York City, is on leave of absence preparatory to retirement. Mr. Newell joined the Board in 1909, and for many years was chairman of the National Fire Protection Association committees on gases and flammable liquids. During World War I he headed the War Department's Bureau of Fire Prevention, and in the recent war assisted in the supervision of the government's shipbuilding operations.

George M. O'Rourke, assistant engineer, maintenance of way, for the Illinois Central Railroad, has been elected president of the American Railway Engineering Association. **William J. Hedley,** assistant chief engineer of the Wabash Railroad Co., will be senior vice-president of the Association.

Donald M. Baker is one of eight winners of a national competition sponsored by the Urban Land Institute, a research organization in urban planning and development. A consulting engineer in the Los Angeles firm, Ruscardon Engineers, he received the "Certificate of Merit" at a luncheon meeting of the directors of the California Real Estate Association held in Long Beach on March 12. He is the only winner from the Western States.

(*Continued on page 108*)

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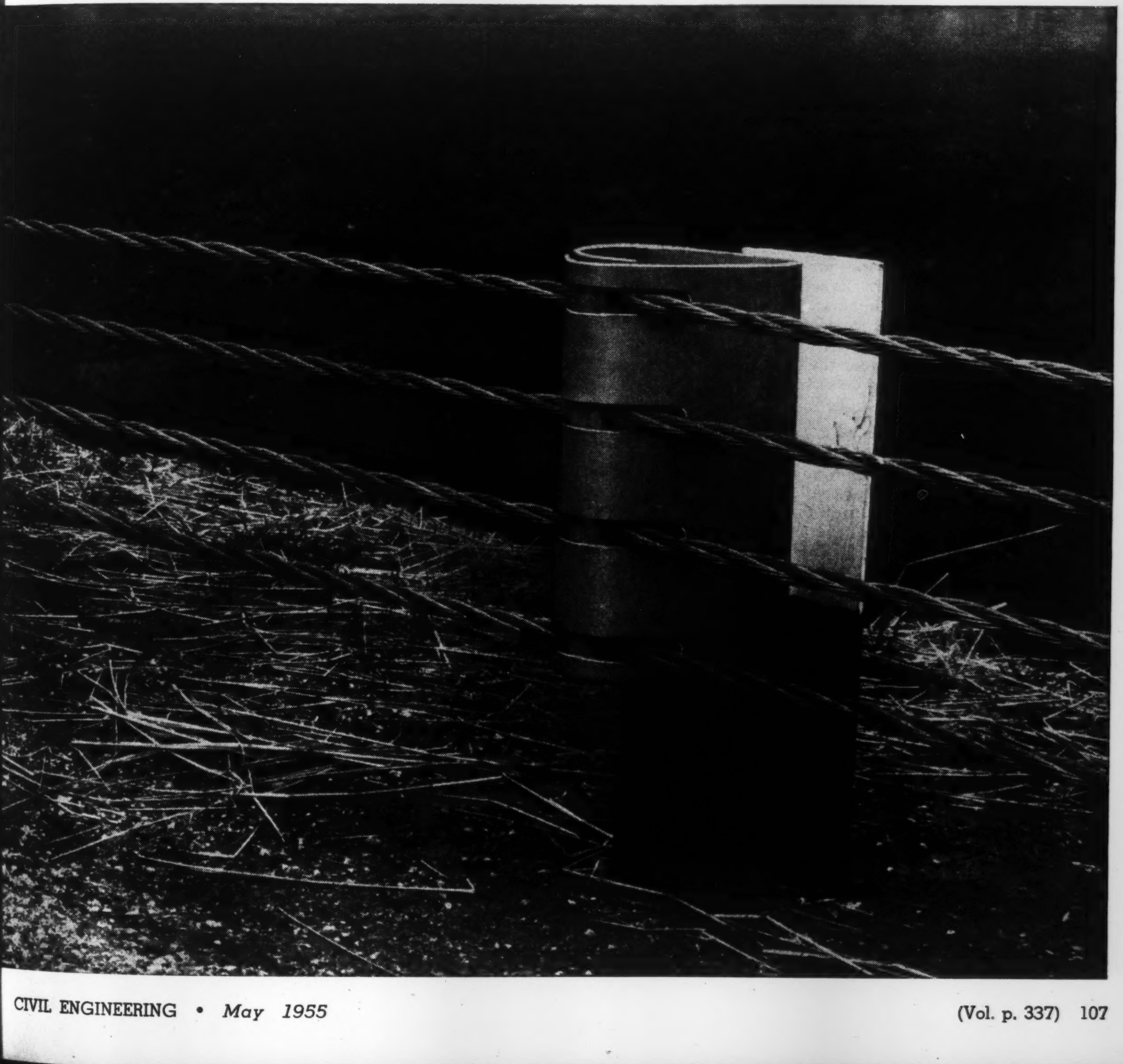
USS



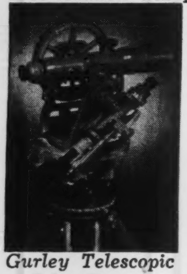
THE SURVEYOR'S NOTEBOOK

Reporting on Unusual Surveying Problems and Their Solutions
Notekeeper: W. & L. E. Gurley, Established 1845

A Few "Tricks of the Trade"

Unusual Field Tips Suggested by Readers of "The Surveyor's Notebook"

A Louisiana engineer has come up with an interesting method of locating shot points during seismograph surveys. The shot location was practically inaccessible in the bayous. However, general direction was known from two points on a base. When the shot was sent off, considerable dirt and smoke were blown into the air; and two transits intersected the shot to give location close enough for practical purposes. (*Speaking of inaccessible sights,* the Gurley Telescopic Solar Transit quickly gets around obstructions with sun shots. Procedure of carrying a line forward with a Gurley Solar eliminates one man from a party. The time and labor saved "pay off" the instrument in a few seasons. Write for information on Model 112-RT.)



Gurley Telescopic Solar Transit

* * *

For night work, an automobile spotlight can aid the surveyor greatly. One engineer directs his vertically... uses suspended plumb lines at right angles to each other to plumb the beam. The beam is used for signaling when the transit party is to take the sight... sight is taken on the vertical beam when it appears in the sky.

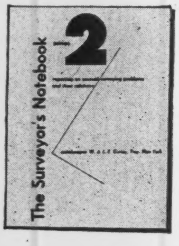
* * *

Some engineers ask for horizontal stadia lines on their transit reticles. This permits use of a horizontal rod—or even a common tape—for measuring distance. Using a right angle prism or Locke hand level with a right angle, a line is laid off perpendicular to the line of sight; and two targets such as pins or range poles are set on this line so that they are exactly matched to horizontal stadia. Distance between the two can then be measured, giving a means of determining stadia distance.

* * *

Can you use these field aids? Gurley can supply 50-pound test yellow nylon plumb bob cord, to add to the visibility of your string in poor lighting. Also a cord adjustor, which helps you make quick changes in line length in the field. Send 25 cents in stamps or coin for a set of cord and adjustor with a drawing showing how to use them.

* *



"The Surveyor's Notebook" collection (Series Two) is packed with valuable tips like these. More than 40,000 surveyors and engineers are finding them helpful. Write for your free copy ...At the same time, why not send us your own story?

W. & L. E. GURLEY
518 Fulton Street, Troy, N. Y.

GURLEY Surveying and Scientific Instruments

News of Engineers

(*Continued from page 104*)

Carlton C. Robinson has joined the Traffic Engineering Division of the Automotive Safety Foundation. He is a resident of Portland, Oreg.

William A. Bellisle, construction superintendent of the Ray M. Lee Co., of Atlanta, Ga., is the new executive secretary of the North Carolina Concrete Masonry Association.

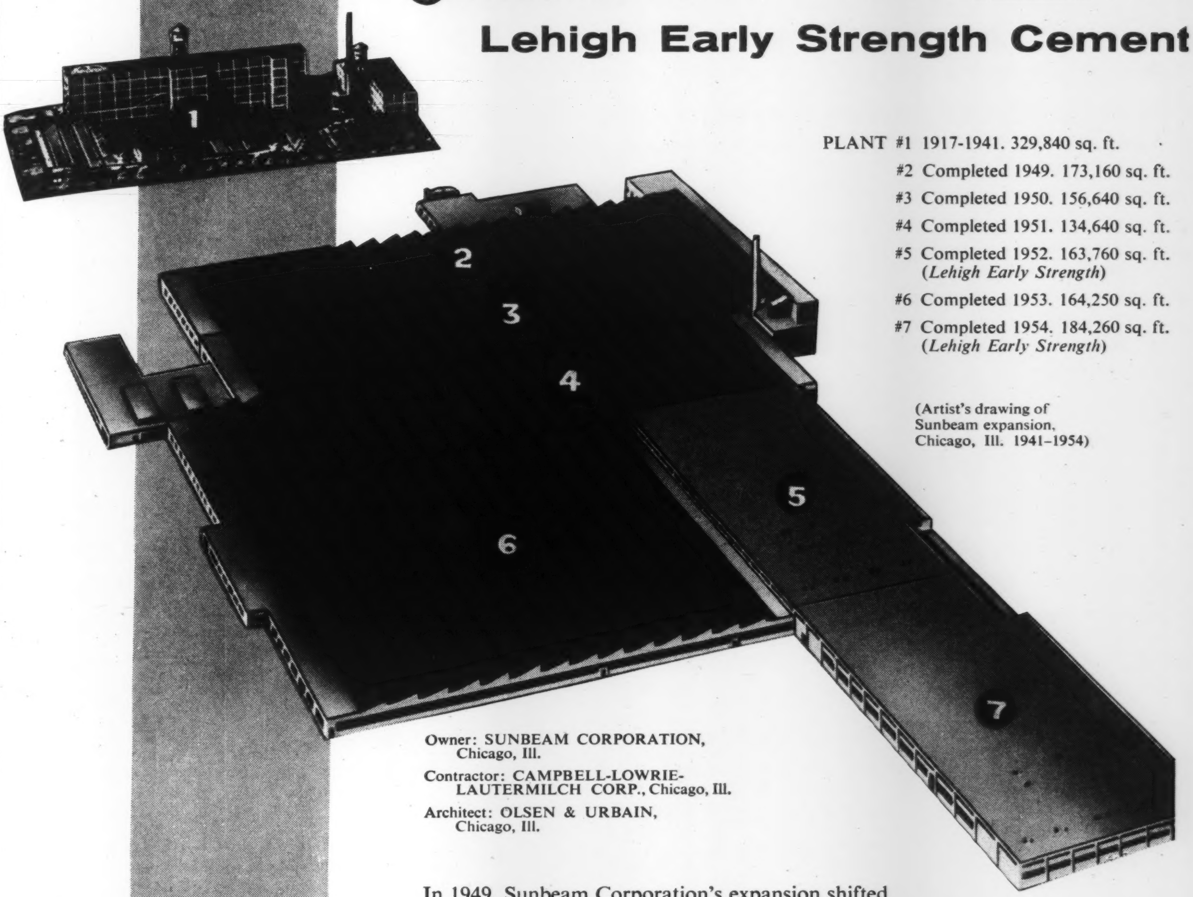
New in Education

New Courses. The first course on prestressed concrete to be given and completed in the United States was at Brooklyn Polytechnic Institute. Odd Albert, associate professor there, announces that the course will be offered again this fall. Of 32 taking the course 22 finished with a grade of "B" or better. . . . . . . Intensive courses for practicing engineers will be given during the University of Michigan's Summer Session. The College of Engineering has staggered these one- and two-week courses throughout the summer. Brochure may be obtained from the University of Michigan, 2028 East Engineering Building, Ann Arbor, Mich. . . . . . Summer courses at the University of Pittsburgh will offer a course in the ecology of fresh waters in relation to human use. It will be given at the Pymatuning Laboratory of Field Biology at Linesville, Pa., June 13–July 1. Address inquiries to M. A. Shapiro, Graduate School of Public Health, University of Pittsburgh. . . . . . . An intensive two-week course in "Nuclear Reactors and Radiations in Industry" will be given at the University of Michigan, August 15–26. Deadline for registration is June 1, and the tuition is $200. . . . . . A course in soil engineering for airfields and highways will be given July 5–15 during the Summer Session at Massachusetts Institute of Technology. Tuition is $160, and applications must be received by June 21.

Scholarships, Fellowships and Grants. Research fellowships in sanitation at Rutgers University are open for July and September. Stipend starts at $1,716, with fellows devoting half time to research and twelve credit hours towards M.S. or Ph.D. degrees. Further information from Dr. Howard E. Orford, chairman Department of Sanitation, the Tower Building, Rutgers University, New Brunswick, N.J.

Errata. Our apologies for attributing sponsorship of a series of structural lectures given by the Boston Society of Civil Engineers to the Engineering Societies of New England in a "New in Education" item in the February issue. The Northeastern Section of ASCE is also a sponsoring group.

Sunbeam goes forward faster with Lehigh Early Strength Cement



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	#6	Completed 1953. 164,250 sq. ft.
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(Artist's drawing of Sunbeam expansion, Chicago, Ill. 1941–1954)

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Their choice of Lehigh Early Strength Cement for midwinter work on addition #5, for example, resulted in *a saving of 35 days construction time and $14,000 in forms, curing and overhead costs.* Similar results were obtained from its use during cold weather construction of addition #7. On the other additions, built in moderate weather, the contractor used dependable Lehigh Portland Cement.

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AGAIN "FLEXIBLES" PROVE THEIR WORTH

WHEN *Flash Floods*

HIT BUTLER, PA.

This huge pile of dirt and roots is typical of those removed from sewers in many parts of the city after the flash floods hit Butler last October.

Mr. Ollie Keck, Sewer Superintendent (at right), praises his crew, and gives due credit to "Flexibles," too . . . stating they were fortunate to have them on hand, and that they have paid for themselves many times.

The "Flexible" Bucket cleaning this 24" line has a capacity of 2.3 cu. ft., and the Bucket Machines can pull it with a full load at 125 ft. per minute. Our "Surface-Hung Manhole Rollers," used here, permit set-ups in water-filled manholes.

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Non-ASCE Meetings

Alaska Science Conference. Sixth Conference sponsored by the Alaska Division, American Association for the Advancement of Science, at the University of Alaska, College, Alaska, June 1–4. Information from A. S. Buswell, Secretary Alaska Division, A.A.A.S., Box B, College, Alaska.

American Institute of Electrical Engineers. Summer General Meeting at the New Ocean House, Swampscott, Mass., June 27-July 1.

American Material Handling Society. Conference in conjunction with the National Materials Handling Exposition at the International Amphitheatre, Chicago, May 16-20.

American Society for Engineering Education. Sixty-third Annual Meeting at the Pennsylvania State University, University Park, Pa., June 20–24. Headquarters and banquet, June 23, at the Hetzel Union Building.

American Society for Testing Materials. Fifty-eighth Annual Meeting at the Chalfonte-Haddon Hall, Atlantic City, N.J., June 26-July 1. Annual dinner, June 29.

American Water Works Association. Seventy-fifth Annual Convention at the Conrad Hilton Hotel, Chicago, Ill., June 12-17.

American Welding Society. National Spring Meeting and Welding Show in Kansas City, Mo., June 7–10. Technical sessions at the Hotel Muehlebach, Exposition in the Kansas City Auditorium. Hotel accomodations from the Housing Bureau, American Welding Society, 33 W. 39th St., New York 18, N.Y.

Design Engineering Show. Show, successor to the Basic Materials Exposition, at Convention Hall, Philadelphia, May 31-June 3. Advance registration cards and information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

International Building Exhibition. First international materials, equipment and plant exhibition at Saint-Cloud National Park, Paris, France, June 25-July 10. Sponsor is Formes & Techniques, Paris, France.

International Organization for Standardization. General Assembly Meeting in Stockholm, Sweden, June 8–18. Details from D. E. Denton, Public Relations Department, American Standards Association, 70 E. 45th St., New York 17, N.Y.

International Vacuum Concrete Convention. Paris Convention at the George V Hotel, Paris, France, June 6–11. Further information from K. P. Billner, c/o Billner Vacuum Concrete, S.A., 4210 Sansom St., Philadelphia 4, Pa.

Iowa Institute of Hydraulic Research. Sixth Hydraulics Conference at the State University of Iowa, Iowa City, Iowa, June 13–15. Advance registration and reservations to Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City.

National Fire Protection Association. Fifty-ninth Annual Meeting at the Hotel Netherland Plaza, Cincinnati, Ohio, May 16–20.

National Society of Professional Engineers. Annual meeting at the Bellevue-Stratford Hotel, Philadelphia, Pa., June 2–4. Information from N.S.P.E., 1121 15th St., N.W., Washington 5, D.C.

Society of Automotive Engineers. Golden Anniversary Summer Meeting at the Chalfonte-Haddon Hall, Atlantic City, N.J., June 12–17.

Society of Naval Architects and Marine Engineers. Spring meeting at the Bellevue-Stratford Hotel, Philadelphia, Pa., May 19–20.

Thermodynamics Conference. Conference sponsored by Pennsylvania State University at University Park, Pa., June 27–29. Sponsors are the National Science Foundation and the American Society for Engineering Education. Further information from Dr. W. Ranz, University Park, Pa.

Traffic Control Conference. Third Annual Conference at Purdue University, May 19–20. For further information write J. E. Baerwald, Joint Highway Research Project, Purdue University, West Lafayette, Ind.

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Pumping Contractors: American Dewatering Corp., New York, Houston, Texas

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... low cost SONOVOIDS make it possible.

Walkways on both sides of this new street bridge in Charlotte, N. C. contain voids created by 9″ O.D. SONOVOID Fibre Tubes. These low-cost SONOVOIDS were used to reduce weight without impairing structural strength. SONOVOIDS displace the low-working concrete below the neutral axis to eliminate dead weight and save reinforcing steel.

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New Publications

Traffic Studies. Down-to-earth recommendations for solving the traffic problem constitute a valuable new booklet prepared jointly by the Transportation and Communication Department of the Chamber of Commerce of the United States and the Automotive Safety Foundation. Entitled, *How to Get the Most out of Streets*, the 50-page publication is profusely illustrated. There is a graduated scale of prices, ranging from $1 a copy for up to five copies to 50 cents a copy for 51 copies and over. Inquiries should be addressed to the Transportation and Communication Department, Chamber of Commerce of the United States, Washington 6, D.C.

Professional Engineering. An up-to-date revision of Samuel S. Aidlin's *Professional Engineering Economics and Practice*, which includes notes and data presented as part of the Review Course for the New York State Engineering License Examination, is now available from Pelex Publishers, Inc., 95 Liberty Street, New York 6, N.Y. A particularly helpful feature is the author's practical approach to problems in professional ethics, fees, contracts, business law, patents, and testimony. Copies are $3.50 each.

City Planning. To give an idea of the scope of its graduate program in city planning the Yale University Department of Architecture has issued an interesting selection of papers and projects entitled *City Planning at Yale*. Copies, priced at $1.50 each, may be ordered from the Department of Architecture, Yale University, New Haven, Conn.

Illinois Floods. Release of a comprehensive report on the magnitude and frequency of floods on Illinois streams is announced by the Illinois Department of Public Works and Buildings, Division of Waterways. Entitled "Floods in Illinois: Magnitude and Frequency," the report is a cooperative project of the Division of Waterways and the Water Resources Division of the U.S. Geological Survey. It includes a tabulation of the crest elevation and discharge for all floods that have been observed by the Survey during the operation of more than 100 gaging stations at different points on the streams. Author of the report is William D. Mitchell, M. ASCE, hydraulic engineer for the Survey at Champaign, Ill. Copies may be obtained from the Chief Engineer, Illinois Division of Waterways, 201 West Monroe Street, Springfield, Ill.

Plastic Deformation of Metals. An experimental investigation of the mechanics of plastic deformation of metals—conducted by the Mechanical Engineering Division of the University of California—is reported in one of the recent University of California Publications in Engineering Series (Vol. V, No. 4). The authors are E. G. Thomsen, C. T. Yang, and J. R. Bierbower. Copies may be purchased from the University of California Press, Berkeley 4, Calif., for 75 cents.

University of Illinois. Recent University of Illinois bulletins detailing important research carried out in its Engineering Experiment Station include No. 424, "The Distribution of Concentrated Loads by Laminated Timber Slabs," by Whitney C. Huntington and William A. Oliver, Members ASCE, Melvin W. Jackson, A. M. ASCE, and William T. Cox; No. 425, "Effect of Body Feed on the Filtration of Water Through Diatomite," by Harold E. Babbitt, M. ASCE, and E. Robert Baumann, J. M. ASCE; and No. 426, "Inelastic Behavior of Ductile Members Under Dead Loading," by M. E. Clark, H. T. Corten, and O. M. Sidebottom. Nos. 424 and 426 sell for $1, and No. 425 for 80 cents. Requests should be sent to the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Steel Products. Issuance of a new section of its Steel Products Manual, a continuous compilation covering the major steel products, is announced by the American Iron and Steel Institute. The present section deals with Hot Rolled Carbon Steel Strip. Inquiries should be sent to the Institute at 350 Fifth Avenue, New York 1.

(*Continued on page 114*)

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. . . easily extended right on the job

All it takes is a fast, simple weld to extend Monotube steel piles to any required length. Either standard sections, or for added economy, cut-offs from previously driven piles can be used. And while one pile is being extended, driving continues on an adjacent pile. There's *no* lost time!

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. . . yet costs less than other quality engineers' transits

LIKE every White quality-built instrument, these engineers' transits give you greater dollar-for-dollar value than any other comparable unit.

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In addition, White engineers' transits give you internal focusing, covered leveling screws, and coated optics. These and a host of other design and operating features combine to give you a transit unsurpassed for ease, speed, accuracy, economy and long-lived dependability. Write for Bulletin 1053 and the name of your nearest dealer. DAVID WHITE COMPANY, 359 W. Court Street, Milwaukee 12, Wisconsin.

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New Publications

(*Continued from page 112*)

Hydraulics. Two hydraulic model investigations conducted at the Waterways Experiment Station at Vicksburg are described in recent Corps of Engineers Technical Memoranda—No. 2-337, entitled "Delaware River Model Study, Report No. 2, Salinity Tests of Existing Channel," and No. 2-393, entitled "Sluice Outlet Portal and Spillway Flip Bucket, Hartwell Dam, Savannah River, Georgia." Copies, priced at $1 each, may be ordered from the Waterways Experiment Station, Vicksburg, Miss.

Beach Erosion. Availability of a limited number of new publications for free distribution is announced by the Beach Erosion Board. These Technical Memoranda are identified as No. 45, which presents the results of a theoretical investigation of the transformation (including energy loss) of waves in shallow water by bottom friction, percolation, refraction, and shoaling; No. 46, which gives the results of field investigations in the Gulf of Mexico for wave energy losses in shallow water; and No. 51, which describes a numerical method for determining the generation of wind waves over a shallow bottom.

Atomic Bomb Damage. The results of a research investigation conducted by the Pittsburgh-Des Moines Steel Company for the Atomic Energy Commission—for the purpose of making a theoretical analysis of the effects of atomic bomb blasts on elevated tanks and standpipes of the type normally used in the atomic energy industry—are set forth in an AEC publication identified as WASH-182, issued by the Technical Information Service at Oak Ridge, Tenn. The 100-page mimeographed bulletin is for sale for 70 cents from the Office of Technical Services, Department of Commerce, Washington 25, D.C.

Nailed Trussed Rafters. A complete study showing how to build nailed trussed rafters for most residential requirements—written by E. George Stern, M. ASCE, research professor of wood construction, Virginia Polytechnic Institute, Blacksburg, Va.—has been issued as a reprint by *Practical Builder*, 5 South Wabash Avenue, Chicago 3, Ill. Designs are based on experimental data obtained in the Wood Research Laboratory at VPI under the auspices of Independent Nail and Packing Co., manufacturer of "Screwtite" nails, which are used in the designs. The publication covers trussed rafters for spans of from 18 to 36 ft, and for pitches ranging from 3 in 12 to 6 in 12. The trusses are designed for a 35-lb live and dead roof load and a 10-lb ceiling load. Deflection is held within 1/360 of the span. Inquiries should be addressed to either Professor Stern or *Practical Builder*.

Engineering Mechanics. Publication of the proceedings of short courses held at Pennsylvania State University in June 1954 and dealing with high temperature properties of materials and mechanics of creep is announced by Prof. Joseph Marin, A.M. ASCE, head of the Department of Engineering Mechanics. Prices are $2.50 for the Proceedings of the High Temperature Properties of Materials Course and $3.50 for the Mechanics of Creep Course. They are available from Dr. Marin at Pennsylvania State University, University Park, Pa.

Structural Design. For the convenience of the man in the field, James J. Kerley, assistant professor of civil engineering at George Washington University and registered civil engineer in Maryland, has written a booklet on *Structural Design Nomographs* which should save many tedious man hours of petty computation. Suggested uses for it include the determination of sizes, cut and fill, weight, basic stresses, ball-park estimates, checking prints, etc. The price is $1 postpaid, with copies obtainable from Mr. Kerley at 6203 Forest Road, Cheverly, Md.

Utilization of Scientists. The critical current shortage of trained science and mathematics teachers in the United States is stressed in the recently released Fourth Annual Report of the National Science Foundation. The report covers the steps taken by the Foundation and other federal agencies to implement President Eisenhower's executive order concerning government scientific research issued last March. Copies of the report may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., for 50 cents.

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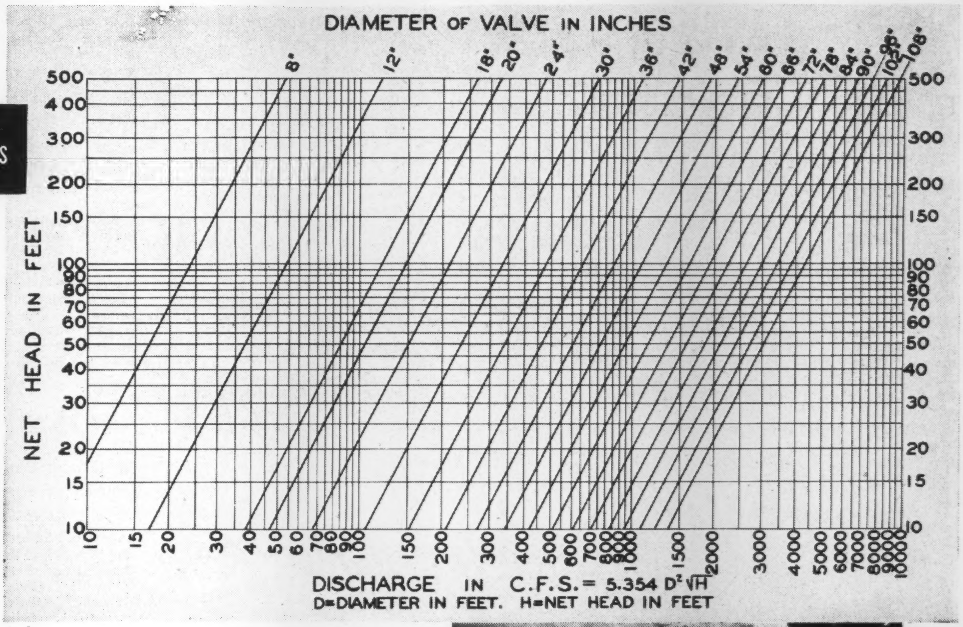

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RECENT BOOKS

Analysis of Statically Indeterminate Structures

A more extensive treatment than usual is accorded the subject in order to make the book useful to practicing engineers as well as undergraduate and graduate students. The first part of the book is a detailed exposition of basic theory, covering deflections by the method of work and by special methods; slope deflection; and moment distribution, including the new method of moment distribution in which sidesway takes place automatically as joints are balanced in the normal rotation process. The second part of the book deals with applications of theory to continuous girders and trusses, frames, arches, and suspension bridges. Numerous worked out examples are given. John I. Parcel and Robert B. B. Moorman are the authors. (John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., 1955. 571pp., $9.50.)

ACI Standards—1954

This compilation of reprints from the ACI Journal, 1945–1954, presents in readily usable form all the current standards of the Institute except those on detailing reinforced concrete structures and reinforced concrete highway structures. (American Concrete Institute, 18263 West McNichols Road, Detroit 19, 1954. Various paging, $3.50—members $1.75.)

National Research Council Highway Research Board, Proceedings of the Thirty-Third Annual Meeting, 1954

Over forty papers presented at the meeting are reprinted in this volume in the following groups: economics, finance, and administration; design; materials and construction; maintenance; traffic and operations; and soils Some typical subjects dealt with include paint failures; fly-ash in air-entrained concrete; traffic operation at tunnels; and measurement of sheer stresses in soil mass. A list of papers appearing in other publications of the Board is included. (National Research Council, Washington 25, D.C., 1954. 563 pp., $8.50.)

Falk's Graphical Solutions to 100,000 Practical Problems

A compilation of 400 worked out graphs covering standard calculations for a wide range of practical problems in mechanics, hydraulics, physics, chemistry, shop-work, construction, electricity, weights and measures, and other fields. In this edition, prepared and edited by Karl H. Falk, workable formulas accompany many of the graphs, which are of the simple type giving the solution at the intersection of two lines traced from the known quantities. (Columbia Graphs, Columbia, Conn., 4th edit., 1954. 419 pp., $6.00.)

International Association for Bridge and Structural Engineering, Publications

Volume fourteen—1954

Seven English, three French, and four German papers covering a variety of topics in the theory and practice of bridge and structural engineering. Some representative subjects treated are the following: effects of variable repeated loads in structures designed by the plastic theory; statistical calculations of the strength of reinforced concrete beams; suspension bridges—the aerodynamic problem; and the theory of fatigue strength. Summaries are given in three languages. (Verlag Leemann, Zürich, 1954. 318 pp., Sw. Frs. 38.00.)

Schüttbeton aus Verschiedenen Zuschlagstoffen
Die Ermittlung der Kornfestigkeit von Ziegelsplitt und Anderen Leich & betonzuschlagstoffen

Deutscher Ausschuss für Stahlbeton, no. 114

Two reports on tests carried out at the Aachen Institute of Technology. Report I by A. Hummel and K. Wesche is on poured concrete made from various aggregates such as river gravel, blast-furnace slag, broken brick, pumice, etc. Report 2 by A. Hummel is on the determination of the granular strength of broken brick and other aggregates for light concrete. (Wilhelm Ernst und Sohn, Berlin, 1954. 30 pp., DM. 7.00.)

Simplified Design of Structural Steel

An elementary treatment by Harry Parker of present-day methods for the design of the most common steel members used in building construction—beams, floor framing, girders, and columns. Separate chapters on riveted, and welded connections are included. In this edition a number of revisions have been made in accordance with changes in practice, and tables of properties of structural shapes have been changed so as to agree with sections now available. (John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16 N.Y., 2nd edit., 1955. 244 pp., $5.75.)

Vibration Problems in Engineering

This standard work by S. Timoshenko on fundamentals and applications of vibration theory has been thoroughly revised to incorporate important new developments. The first chapter on systems having one degree of freedom, has been thoroughly recast; the chapter on non-linear vibrations has been expanded to include new methods of treatment; and the chapter covering elastic bodies has been completely revised. In the latter, new topics, such as combined bending and torsional vibrations of beams, are discussed. The appendix, dealing with measuring instruments, has been omitted from this edition. (D Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3, N.Y., 3rd edit., 1955 468 pp., $8.75.)

(*Continued on page 122*)

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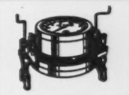

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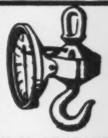

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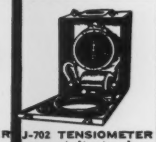

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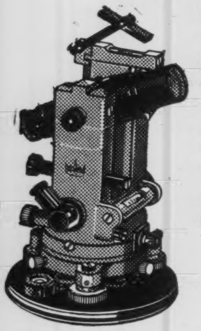

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Advance Reservations

It is most helpful for the Committee to have guidance as to the number of persons to be expected for the various functions. See program, page 62. Please send the coupon above right, which entails no obligation, to Joseph W. Graves, Jr., 3800 West Pine Boulevard, St. Louis 8, Mo.

For hotel reservations, you are urged to send your request as early as possible, using the coupon below, to Joseph B. Brooks, at the address indicated.

Advance Information on Attendance at St. Louis Convention of ASCE

To:

Joseph W. Graves, Jr., *Registration Chairman*
3800 West Pine Blvd., St. Louis 8, Mo.

It is my plan to attend the St. Louis Convention. I shall have . . . . guests attending with me.

During the Convention I plan to attend the following events, tickets for which I shall purchase when I arrive and register:

Function	No. Tickets
Tuesday, June 14	....
Ladies' Luncheon & Book Review	....
Waterways, Hydraulics & Soil Mechanics Joint Luncheon	....
Evening Field Trip: Lambert-St. Louis Municipal Airport	....
Wednesday, June 15	
Convention Luncheon	....
Night Baseball: Cardinals vs. Pirates	....
Evening: Municipal Opera, *Brigadoon*	....
Thursday, June 16	
Ladies Garden Tour & Luncheon	....
Highway Division Luncheon	....
Showboat Dinner Party & "Mellerdrammer"	....
Friday, June 17	
Ladies' Park Tour & Luncheon	....
Construction Division Committee on Pipelines Luncheon	....
Field Trip: Aeronautical Chart & Information Center	....
Field Trip: Waterways Tour of Chain-of-Rocks Canal & Locks	....

St. Louis Convention of ASCE

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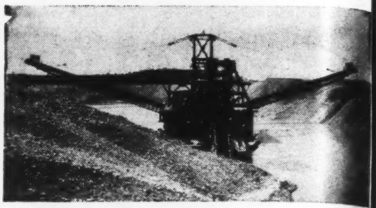
traveling by train........ auto........ plane........ bus.........



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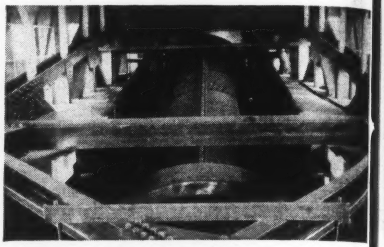

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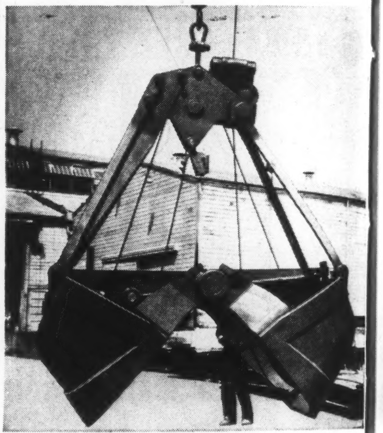

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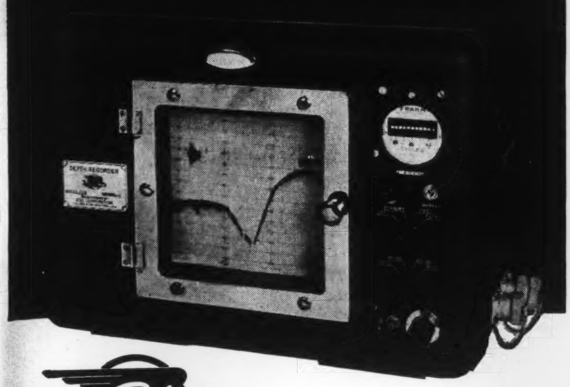

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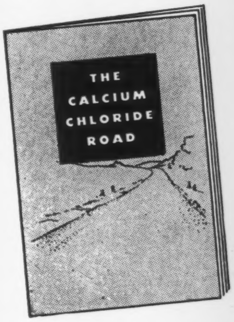

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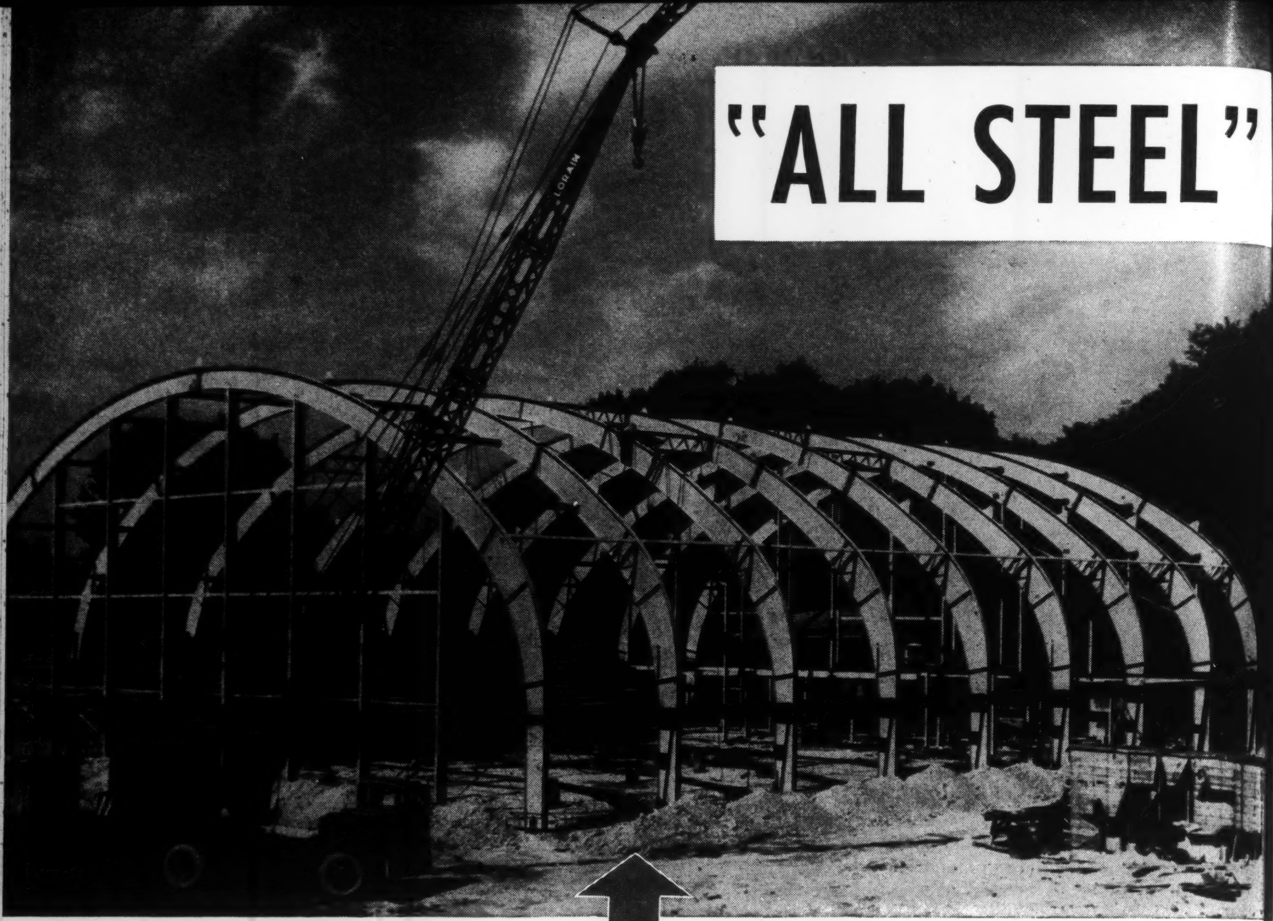

The Structural Steel framework during erection. The tied rigid frames were erected in three pieces, each frame requiring but two hours to set in place. The frames, structural members, and balcony deck totaled 201 tons.

The Field House in the final stages of construction. Steel roof and sidewall Z panels were shop assembled in sections measuring 6' x 18'. Each section required only 10 minutes to set in place. The Z panels were made of 16 gage black sheets, and totaled 101 tons.

FIELD HOUSE erected at Allegheny College

THE NEW FIELD HOUSE at Allegheny College, Meadville, Pa., is virtually an "all steel" structure, since the rigid frames . . . the roof . . . sidewalls . . . entry ways . . . windows . . . all the trim . . . and even the balcony deck are of steel.

Installations such as this illustrate the amazing versatility of steel — the versatility that permits steel to do *so many jobs so well.* And they illustrate, too, the strength and safety offered by Structural Steel. It's common knowledge that Structural Steel is the strongest of load-carrying materials. It will withstand more abuse than other structural materials, effectively resisting tension, torsion, compression and shear. Yet, Structural Steel is the most economical of load-carrying materials. Enclosed in buildings, it will last indefinitely—requiring no maintenance. Equally adaptable to riveting, welding or bolting, it can be erected in any weather in which men can work. Moreover, since Steel members are fabricated indoors, weather can have no effect on the quality of workmanship.

* * *

Structural Steel and panel designs, plus fabrication and erection were by the Pittsburgh-Des Moines Steel Company, Pittsburgh 25, Pa. The architect was Lorimer Rich and Associates, New York 9, N. Y. Consulting Engineers to the Architect were Severud-Elstad-Krueger, New York, N. Y. General Contractor was Crump, Incorporated, Pittsburgh, Pennsylvania.

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

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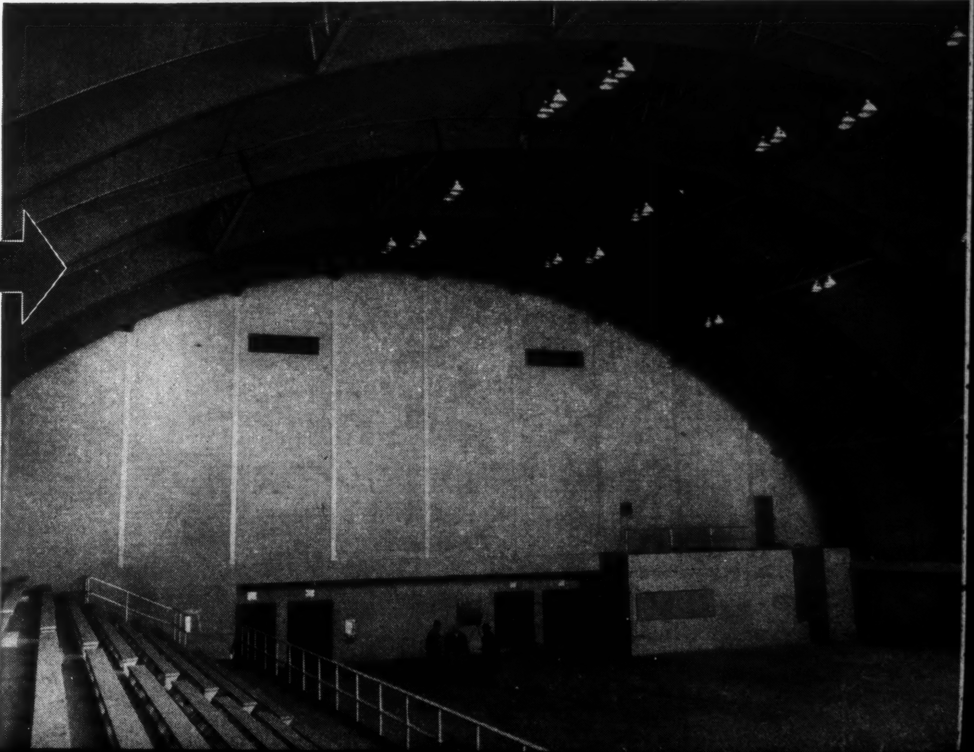
USS STRUCTURAL STEEL

UNITED STATES STEEL

Interior — nearing completion. The Steel deck balcony was designed and built by the Pittsburgh-Des Moines Steel Company under its patents for Steel Deck Grandstands. Opening frames, closures, and trim — all of steel — amounted to 30 tons.



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Low coefficient gives high differential pressure for greatest accuracy.

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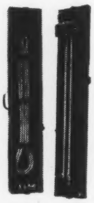

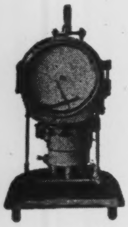

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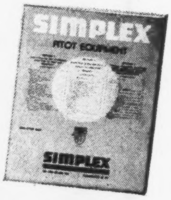

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Recent Books

(*Continued from page 116*)

Applied Geophysics
In the Search for Minerals

An introductory textbook by the late A. S. Eve and D. A. Keys which combines the theoretical and practical approach in dealing with magnetic, electrical, electromagnetic, gravitational, seismic, and radioactive methods of exploration. Various well-logging methods are discussed in a separate chapter. Recent developments which have occurred since publication of the previous edition in 1938 are taken into account, and new material is included on aerial survey instruments, gravimeters, seismic reflection, and methods of locating radioactive ores. (Cambridge University Press, 32 East 57th Street, New York 22, N.Y., 4th edit., 1954. 382 pp., $7.50.)

The Chemistry of Portland Cement

This extensive treatise, by Robert Herman Bogue, the Director of the Portland Cement Association Fellowship at the National Bureau of Standards, has been thoroughly revised to include recent research developments. Important new work on molecular and crystallographic structure and on methods of testing are incorporated. Detailed treatments of clinker constituents, high-temperature phase research, hydration, setting and hardening constitute the major part of the book, with additional chapters on the history, classification, manufacture and testing of cement. A reference work for engineers and chemists, as well as an extended text for students. (Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y., 2nd edit., 1955. 793 pp. $16.50.)

Positions Announced

New York City Civil Service Commission. New York City has five high-paying positions open: three are for engineers or architects with eight and ten years of experience; two are for property management with similar experience plus construction and alteration knowledge. Salary is from $7,900 to $12,000. Four jobs are with the Board of Education and the other is with the Department of Housing and Buildings which requires New York residence. For further information, write Ernest E. Johnson, Director of Recruitment and Public Relations, Personnel Department, Civil Service Commission, 299 Broadway, New York 7, N.Y.

City of Kenosha. The city of Kenosha, Wis., is accepting applications for Engineers—both permanent and temporary. Salary range is from $4,200 to $6,600 depending on experience. There is opportunity for diversified experience in street paving, storm sewers, sanitary sewers, and water supply plus state retirement and other benefits. Applications should be sent to City Manager, City Hall, Kenosha, Wis.

New York State Civil Service Department. Competitive examinations for Engineers and Architects will be held June 25. Applications will be accepted up to May 27. Address inquiries to Information Desks, Examinations Division, 39 Columbia St., Albany, N.Y.

ENGINEERING SOCIETIES

PERSONNEL SERVICE, INC.

NEW YORK	CHICAGO	DETROIT	SAN FRANCISCO
8 W. 40th ST.	84 E. RANDOLPH ST.	100 FARNSWORTH AVE.	57 POST ST.

This placement service is available so members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient non-profit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

HYDRAULIC AND SANITARY ENGINEER; A.M. ASCE; 30; single; M.S.C.E.; registered P.E. Nine years' comprehensive experience in consulting engineering field in responsible charge—various phases of investigation, design, and construction of water supply, sewerage, and drainage facilities. Public works and industrial. Presently employed. Free to travel or relocate; U. S. or Foreign locations. C-43.

MANAGEMENT ENGINEER; J.M. ASCE; married; graduate engineer 1946; seven years' experience, consulting and plant engineering. Currently attending Harvard Graduate Business School, graduating June 1955. Desires management position, line or staff, where, on basis of experience and recent graduate study in business administration, opportunities exist for advancement to general management. Available June 1st. C-44.

Structural and Civil Engineers

To design oil refineries, chemical plants, industrial plants, and special structures.

Lead positions for registered structural engineers (licensed in California or ability to receive California registration)

Excellent opportunities exist for a wide variety of designs of engineering projects throughout the world.

Please Send Your Resume To:

Parsons
617 South Olive Street
Los Angeles 14, California

APPLIED MECHANICS ENGINEER; J.M. ASCE; B.C.E. (magna cum laude); Master of applied mechanics; 31; married; ten years' research experience and publications in theory of sandwich construction, swept-wing stress analysis, creep strength of columns, elastic stability, vibration of plates and shells. Presently employed as applied mathematician. Desires teaching position. C-45.

CIVIL ENGINEER; J.M. ASCE; 28; married; B.S.C.E., '49. Three years' experience in mapping, drafting, highway planning division. Three years' experience and presently employed as manager of non-engineering business. Some light experience in building homes (self-employed). Desires position in midwest or west with large building contractor with possibilities of working up into management. C-46-150-Chicago.

ASSISTANT PROFESSOR; A.M. ASCE; 43; married; ten years' experience in teaching structures, surveying, mechanics, etc.; ten years' experience in structural design, surveying, and construction; licensed Professional Engineer and Land Surveyor; desires position as professor, associate professor or as design engineer with consulting firm. C-47.

CIVIL ENGINEER; J.M. ASCE; 29; married; B.S.C.E.; four years' diversified experience as Project Engineer—covering complete job from office design to field supervision—including design, estimating, specifications, and field supervision on steel superstructures, reinforced concrete and layout of small community with all utilities. Schooling includes two years' Architectural Design. Location preferred, Midwest. Available September, 1955. C-48.

CIVIL ENGINEER; J.M. ASCE; 30; married; B.S.C.E.; P.E. Illinois; P.E. Missouri; Reg. Ill. Land Surveyor; diversified experience with consulting firm; city sub-division design and layout; city, county streets and roads; industrial construction layout; presently Chief Office Engineer with consulting firm; desires supervisory position. C-49-173-Chicago.

CIVIL AND STRUCTURAL ENGINEER; J.M. ASCE; recently graduated from the University of California with several months' experience in foundations and bridges; desires an engineering position with an outstanding organization in New York City. C-50.

GENERAL MANAGER, CHIEF ENGINEER OR RESEARCH DIRECTOR; age 35; experienced in metals fabrication, production machining, government contracts, labor relations, management function. C-51.

CIVIL ENGINEER; University Degree; P.E.; 38; Project Engineer with twelve years' experience covering design work in structural steel, reinforced concrete, heavy foundations and bridges, familiar with site work and office routine. Capable of heading a team and to work on own initiative, able to negotiate with clients and authorities. Seeks change, location preferrably East but also willing to travel overseas. C-53.

Positions Available

INSTRUCTOR; civil engineering; preferably with M.S. degree, practical or teaching experience; major interest in sanitary engineering desired but not required. Position open in the fall of 1955. Location, Midwest. W-923.

DESIGN ENGINEER; civil graduate; 35–50; with at least five years' design and layout of road construction, drainage facilities and general site adaptation on airfield project. Salary, $9,600 a year plus $12 a day living allowance. Duration, six months. Location, France. F-956.

CHIEF ENGINEER; Will be in charge of all new design and construction, replacement of worn and obsolete equipment and must know about the operation of water softening plants and sewage treatment plants. Salary about $10,000 a year. Location, South. W-1033.

STRUCTURAL
DESIGNERS & DETAILERS

Prefer CE or Arch E with several years' experience in bridges, industrial buildings, or pressure vessels and heavy ducting. Will consider lesser experience with good educational background in structural analysis.

Unusual engineering opportunities exist in our well established firm in connection with the design, construction supervision and inspection of a wide variety of engineering projects in both concrete and steel. Included are bridges, industrial buildings, advanced test facilities and other construction of an industrial nature, and various types of highway work.

Please write fully to—

SVERDRUP & PARCEL, INC.
Consulting Engineers
915 Olive St. Louis 1, Mo.

Assistant Director of Public Works; civil graduate; experience essential in street design and construction, storm water drainage and related work. Executive ability desirable. Salary, $7,200 a year. Location, South. W-1047.

Chief Construction Estimator; Civil graduates; under 55; with at least ten years' supervisory estimating experience covering steam and hydro-electric power plants and general heavy construction projects. Salary, $10,000 a year. Location, New York, N. Y. W-1108.

Designer; civil or naval architect; under 45; with experience covering design, specification and construction of barges and off shore drilling facilities. Salary, $8,000–$10,000 a year. Location, Texas. W-1185.

Teaching Personnel; to teach general civil engineering subject in civil engineering department. Positions available September 1, 1955. Salary, dependent upon rank and experience, open. Location, Southwest. W-1239.

Instructor, C.E.; to teach general civil engineering and/or mechanics subjects. Teaching experience desirable. Position available September, 1955. Salary and rank dependent on education and experience. Location, South. W-1259.

Sanitary Engineer; 35–45; graduate; experienced in design and construction of water and sewage plants; to develop and analyze operating costs and make recommendations regarding cost control, recommend changes to improve operating efficiency; assist in preparation of plans for expansion of these utilities. Starting salary, $9,000 a year, plus or minus. Location, South. W-1303.

Civil and Structural Engineers

To design new oil-refineries and chemical plants. The work is basically a design of steel and reinforced concrete structures. And site-development engineering.

Please send your resume to our Personnel Department. Your letter will receive immediate and confidential attention.

C F BRAUN & CO
ENGINEERS CONSTRUCTORS
ALHAMBRA
CALIFORNIA

Engineers; (*a*) Chief Design Engineer; Civil; with at least ten years' design and administrative experience on highways and bridges. Salary, $10,000–$12,000 a year. (*b*) Senior Designer; Civil; with at least eight years' drainage and highway location experience. Salary, $7,000–$8,000 a year. (*c*) Structural Designer; Civil; with at least three years' highway or bridge experience. Salary, $5,000–$7,000 a year. Location, New York, N. Y. W-1294.

Instructor; in civil engineering; M.S. degree; who has specialized in either structures or fluid mechanics. Will teach statics, dynamics and strength of materials. Salary, $4,400–$5,000 a year. Location, New England. W-1301.

Design Engineer; B.S. degree in civil or mechanical engineering, and considerable experience in smelter, mill and other industrial plant design work. Must be qualified to advance within two years to supervision of engineering office and the work of ten engineers and draftsmen. Salary open. Location, Midwest. W-1340.

Instructor or Assistant Professor; M.S. degree in civil engineering; to teach mechanics and route surveying. Salary, $4,000–$5,000 for nine months, depending on qualification. Location, northern New York State. W-1345.

Construction Manager; civil graduate; with at least ten years' experience supervising steam and hydroelectric power plants and general heavy construction. Salary, $14,000-$15,000 a year. Headquarters, New York, N. Y. W-1364.

Civil Engineer; 21–40; for a two-year assignment in the development of a crude rubber plantation. Work consists of building roads, factories, hydroelectric plant and other facilities. Salary, $4,800–$5,700 a year, plus foreign service incentive, 40% of base pay, many other benefits. Housing and furniture supplied by company. Location, Liberia. W-1370.

Assistant Director of Research; Civil or Soils graduate; 35. Should have at least five years' experience in construction, design or research on concrete and soils work. A knowledge of photography desirable. Duties will include assisting the director of research and carrying on details of operating laboratory. Must be creative and have good ingenuity; write reports, analyze data, call on field people and assist in solving their problems. Good personality and able to talk with clients. Good opportunity for research laboratory. Salary, about $7,200 dependent on experience. Location, Chicago. C-2739.

Laboratory Engineer; B.S. in C.E. or Soils; 25. Should have at least two years' experience in construction or laboratory work either building or highway. Have a knowledge A.S.T.M. Codes. Duties will include laboratory and concrete inspection, running routine tests, handling test programs of laboratory at operating level, preparing mixes of concrete and mortar. Salary, $6,500–$7,800 a year. Employer might negotiate fee. Location, Chicago. C-2740.

Applications for Admission to ASCE, March 12, 1955–April 9, 1955

Applying for Member

Tracy Leon Atherton, Sacramento, Calif.
Richard Goulden Brickell, Wellington, New Zealand.
John Oscar Buxell, Alexandria, Egypt.
Worth Candrick, Charleston, S.C.
Pedro Carbo Medina, Ecuador South America.
William Champlin Carson, Los Angeles, Calif.
William Amstutz Darling, Ft. Wayne, Ind.
Howard Keeling Faber, Jr., Union, N.J.
Willard Wesley Fryhofer, Kansas City, Mo.
Hego Fuchino, Honolulu, T.H.
Erich Ernest Gronbach, Chicago, Ill.
Tsuneo Kioke, Naalehu, Hawaii.
Orville Richard Lindstrom, Glendora, Calif.
William Roberto Marinho Lutz, Sao Paulo, Brazil.

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MISSILE STRUCTURES ENGINEERS

Challenging problems in:—
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Loads
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Openings at both junior and senior levels. For additional information forward resume to:

Missile & Control Epuipment Dept. C
Engineering Personnel
NORTH AMERICAN AVIATION INC.
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Downey, Calif.

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Designers
Detailers
Draftsmen

For office work on highways, expressways and bridges. Long term project. Desire experience or training including alignment and profile computations, geometric design of interchanges and associated work.

Employee Benefit & Retirement Plan, paid vacations and holidays, sick leave. Modern air conditioned offices in downtown St. Louis. Please write fully to or inquire at

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1134 Locust St.
St. Louis 1, Mo.
1625 Eye St. N. W.
Washington 6, D. C.

GENERAL SALES MANAGER

A national Construction company specializing in concrete construction and maintenance offers an outstanding opportunity for the right man.

Necessary qualifications are a sound engineering technical background, a record of accomplishment in sales activities and the ability to meet and work successfully with men in any position.

The position will include responsibility for over-all planning and direction of a well-organized sales program including sales promotional activities and will carry management level status. The prospect is for earning which will adequately reflect the importance of your contributions.

You will receive consideration and confidential attention if you will send a comprehensive resume of your education, experience, and personal status together with a snap-shot photograph.

INTRUSION-PREPAKT, INCORPORATED
779 Union Commerce Building
Cleveland 14, Ohio
Attn: Mr. E. C. Mardorf

BRIDGE DESIGNER

Richmond, Virginia. Graduate civil engineer, several years experience railway bridge designing. Give age, education, experience, reference, salary.

Box 248
CIVIL ENGINEERING
33 West 39th Street
New York 18, N. Y.

Applications for Admission

(*Continued from page 124*)

Fred Ray Martin, St. Louis, Mo.
Russell Benjamin Maxey, Columbia, S.C.
Takeshi Mori, Maui, Honolulu.
John Anderson Murlin, Austin, Tex.
Samuel Giltner Neff, Portland, Oreg.
Jose Gomez Pinzon, Columbia, S.A.
Mahlon John Plumb, Gary, Ind.
Edward William Riefler, St. Louis, Ill.
John Nicholas Robertson, Washington, D.C.
Merrow Egerton Sorley, Fort Belvoir, Va.
Charles Henry Spamer, San Francisco, Calif.
Judson Woodring Wark, Arlington, Va.

Applying for Associate Member

Rustom Meherwanji Antia, Bombay, India.
Willis D. Barlow, North Highlands, Calif.
George Daniel Bennett, Ft. Lauderdale, Fla.
Keith Howard Best, Colombo, Ceylon.
Karl Brenkert, Jr., University, Ala.
Sheldon Isaiah Burroughs, Meriden, Conn.
Masihur Rahman Chowdhury, Dacca, Pakistan.
Moseley Cary Collins, Jr., Clearwater, Fla.
Leon Peter Cossette, San Francisco, Calif.
Robert George Cox, Vicksburg, Miss.
Desmond Hylton Devine, London, England.
Samir Khalil El-Khuri, Beirut, Lebanon.
Harold Bernard Ellis, Mineral Wells, Tex.
Andrew Anthony Ferlito, New York, N.Y.
Eliseo Gabriel Font, Mayaguez, Puerto Rico
Tommy J. Gingles, Dallas, Tex.
Vance Junior Gray, Toledo, Ohio.
Daland Mellings Griffiths, Bakersfield, Calif.
Soren Vilhelm Gundesen, Millbrae, Calif.
Douglas James Hamilton, Bulawayo, S. Rhodesia.
Daniel Stanton Hammond, Boston, Mass.
Emil Retz Hargett, Auburn, Ala.
Julius Lucoff, Tracy, Calif.
Edward James Mahood, San Francisco, Calif.
Robert William McIntosh, Bangor, Me.
Richard Charles Mills, Ft. Lauderdale, Fla.
Robert Leon Morris, Jr., Knoxville, Tenn.
Asim Kumar Mukherjee, Minneapolis, Minn.
Philip Joseph Mule, New York, N.Y.
Juan Edmundo Muzquiz C., Alhambra, Calif.
Patrick Nash Owens, Rio de Janeiro, D.F. Brazil.
Luis Perez-Arteta,Ecuador, S.A.
Walter Do Couto Pfeil, New York, N.Y.
Yves Pret, Bogota, Columbia.
Albert John Raman, New York, N.Y.
Biskur Kemparamiah Ramiah, Storrs, Conn.
John Louis Reynolds, Baltimore, Md.
Jerome Charles Rosenthal, Mount Vernon, N.Y.
Aldelmo Ruiz-Santiago, Fort Belvoir, Va.
Carl Frank Scott, Kirwin, Kans.
Robert William Shaw, Pittsburgh, Pa.
Frederick Gray Siegrist, Jr., Ames, Iowa.
Ellis Clair Tompkins, New Braunfels, Tex.
Russel Bay Vaile, Martinez, Calif.
Joseph Alexander Wise, Jr., Clarksburg, W. Va.
Erwin Ziffer, Victoria, Australia.

Applying for Junior Member

M. Ashraf, District Montgomery, Pakistan.
Alexander Aloysius Beiro, Alexandria, Va.
Douglas Haig Brackney, Minneapolis, Minn.
Robert Patrick Brennan, New York, N.Y.
Edmund James Corina, Troy, N.Y.
William Henry Daudistel, Portland, Ore.
George Anson Dinsmore, Boulder, Colo.
David Robert Esty, Maracaibo, Venezula.
Jose Affonso Fausto Barbosa, Denver, Colo.
Ruben Baran Fridson, Havana, Cuba.
James Robert Fuller, Urbana, Ill.
Armin Cecil Hurless, Chicago, Ill.
Robert Sanford Jones, Kansas City, Mo.
John James Kelly, Denver, Colo.
Maurice Keyes Kurtz, Jr., Urbana, Ill.
Donald Eugene Martin, Olympia, Wash.
Anthony Nester Mavroudis, New York, N.Y.
Francisco Jose Mera, Ithaca, N.Y.
Billy Edward Morrison, Marysville, Calif.
Donald Clyde Newberry, Jr., Fort Knox, Ky.
John O' Leary, Whiting, Ind.
Albert Aram Ouzounian, Chicago, Ill.
Paul Joseph Pantano, Bridgeport, Conn.
Andrew Leo Poulos, Gary, Ind.
John Bolivar Rael, Santa Fe, N. Mex.
Donald Joseph Sullivan, Troy, N.Y.
Cesar Mariano Urrutia, Baton Rouge, La.
William James Way, Los Angeles, Calif.
Willian Rowley Weaver, Dallas, Tex.
Robert Lewis Wilcox, Cambridge, Mass.
David McLean Wilson, Pasadena, Calif.
William Clifford Wood, Auburn, Ala.

[*Applications for Junior Membership from ASCE Student Chapters are not listed.*]

AIRCRAFT ENGINEERS
With Experience
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LAYOUT DESIGNERS
Airframe Structures
FLIGHT TESTING
Planners
Analysts
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Systems Design
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STRUCTURES
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RESEARCH
Computer Engrs. Digital or Analog
Vibration & Flutter Engrs.
Dynamic Analysis—Systems Engineers
ARMAMENT INSTALLATION
AERODYNAMICS
INSTRUMENTATION
TOOL DESIGNERS
PLANT LAYOUT ENGINEERS

Recent Graduates with Aeronautical, Mechanical, Civil or Engineering Physics Degrees may qualify.

Proof of U. S. Citizenship Required

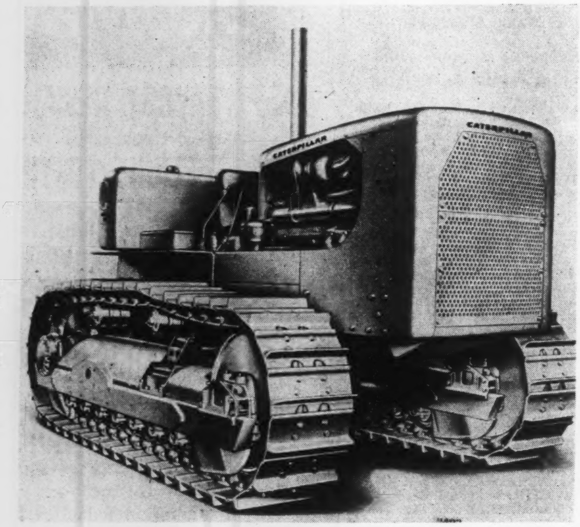
APPLY IN PERSON OR SEND RESUME TO:
Engineering Personnel Dept.
INTERVIEWS AT
Employment Office
South Oyster Bay Road
North of Railroad
Monday thru Friday
8:30–11:30 AM; 1:30–3:30 PM

GRUMMAN AIRCRAFT
Engineering Corp.
Bethpage, N. Y.

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

World's Biggest Crawler Tractor Announced May 1



Rugged D-9 Tractor

THE 30-TON CAT D9, A GIANT MACHINE WHICH IS NOW THE BIGGEST CRAWLER TRACTOR IN THE WORLD, climaxes ten years of research and development by the Caterpillar Tractor Company. The 230-drawbar horsepower unit, weighing 56,000 pounds, became the sixth machine in Caterpillar's track-type line on May 1. The rugged operating qualities of the D9 were proved during an extensive field testing program in 1954. Construction men, loggers, mining men and pipeliners got the opportunity to watch the big unit in action. With it they found the increased power for which they were looking. While the D9 is of major significance in itself, some of the component developments are equally important. The $6^1/_4 \times 8$ in. six-cylinder Cat Diesel Engine is equipped with a turbocharger, an innovation in track-type tractor manufacture, which is powered by exhaust gases. Turbocharging a tractor engine means quieter operation, additional horsepower and more operator comfort. The tractor will also have the oil-type flywheel clutch or optionally a torque converter, in-seat starting, hydraulic track adjustment, excellent operator visibility and many servicing conveniences. Although the tractor is large, general appearance of the Big Yellow will conform to the other models. Length is 17 ft 10 in.; width, 9 ft 11 in.; height, 8 ft 9 in. Ground clearance is 21 in. **Caterpillar Tractor Co., CE 5-126, Peoria 8, Ill.**

For Thermal Insulation

"LAGZ", A PROTECTIVE COATING FOR THERMAL INSULATION, IS COMPOUNDED FROM NEOPRENE AND SILICONE RUBBERS and other resins to provide a coating that is unaffected by moisture, oils, brine, solvents, corrosive gases, chemicals and weathering. It provides a moisture resistant cover which protects insulation from damage by abrasion or puncture and insures high thermal efficiency and low maintenance costs. Manufactured in two grades, "Lagz" No. 1 is a medium viscosity material designed for use with 85% magnesia, calcium silicate, felt, rock wool and asbestos. It can be applied by spraying, brushing, or sponge. "Lagz" No. 2 is a high viscosity material designed for use with low temperature insulation such as cork, foamed plastics, glass fiber and cellular glass. It is applied by brush or trowel and is a perfect vapor barrier. "Lagz" is non-flammable and nontoxic and an excellent adhesive. **West Chester Chemical Company, CE 5-126, Box 39, West Chester, Pa.**

Trussed Tee Sub-Purlin

A LIGHTWEIGHT TRUSSED TEE SUB-PURLIN FOR USE IN POURED AND PRE-CAST TILE ROOF CONSTRUCTION has been announced. One of the features of the Trussed Tee sub-purlin is its lighter weight compared to conventional bulb tees having equal strength. The built-in truss design of the sub-purlin has no solid vertical leg to conduct heat from top to bottom, thereby eliminating the tendency to form condensation on bottom flange. Consisting of two top cords of wire, a truss web of larger wire, and two angles of strip steel, this sub-purlin is a new concept in a roof construction member for load bearing functions. **The Blue Diamond Company, CE 5-126, 2722 Logan St., Dallas 15, Texas.**

Diesel Crawler Tractor

A 31,500 LB. CRAWLER TRACTOR, THE HD-16, WITH TORQUE CONVERTER DRIVE AND STANDARD TRANSMISSION is available this month. The HD-16 has a 6-cylinder, 844 cu in. Diesel engine which develops 150 net engine h.p. at 1800 rpm with torque converter and 140 net engine h.p. at 1600 rpm with standard transmission. Maximum drawbar pull of 60,000 lbs. is obtained with torque converter drive. The tractor has a maximum drawbar pull of 31,700 lbs. at rated engine speed. Under over-load, the engine torque increases, thus resulting in additional drawbar pulls up to 35,945 lbs. at reduced travel speed. **Allis-Chalmers Manufacturing Company, CE 5-126, Tractor Division, Milwaukee 1, Wisconsin.**

Connecting Section

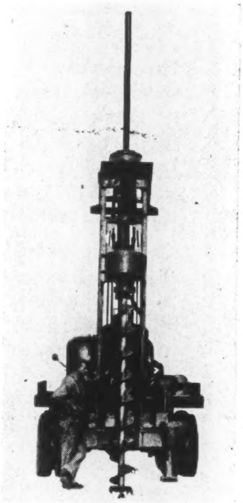
A NEW DESIGN "END SECTION" FOR CORRUGATED METAL STRUCTURES INVOLVES THE USE OF TWO SIDE LUGS and a length of galvanized rod threaded on each end. It is an alternate type of connection for use in 30 in. and 36 in. diameter pipe, and pipe-arches from 18 in. to 11 in. to 58 in. × 36 in. inclusive. On pipe from 12 in. to 24 in. inclusive, the full circumferential rod and lug are used. On 42 in. and 48 in. diameter pipe and the two largest pipe-arches, 65 in. × 40 in. and 72 in. × 44 in. end sections are fabricated with a riveted-on connector section and joined to the culvert barrel with a standard band coupler. **Products Information Service, Armco Drainage & Metal Products, Inc., CE 5-126, Middletown, Ohio.**

Surveyors' Target

"RULE-SITE", IS THE FIRST SURVEYORS' TARGET EVER MADE FOR THE ENGINEERS' SIX FOOT FOLDING RULE. It provides 7 sq in. of sighting surface, and graduations 8 times larger than those on the folding rule, visible on sights of 1,000 ft and more. It slides readily over all six foot folding rules and is easily screw-locked in place at any point, even at the joint or zero point. Sturdy and lightweight, the "Rule-Site" will not cause the horizontally extended rule to collapse. **Rule-Site Co., CE 5-127, Box 93, Baldwin, N. Y.**

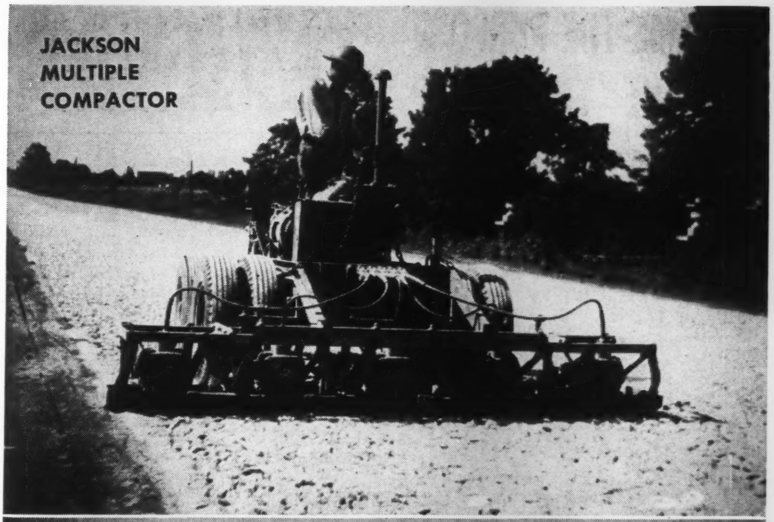
Vertical Drills

HEAVY-DUTY VERTICAL DRILLS ARE PLAYING A LEADING ROLE IN EXPANDING STREET, HIGHWAY, TURNPIKE, BRIDGE, DAM AND RAILROAD CONSTRUCTION. The latest models, known as the McCarthy drills, will handle augers up to 24 in. in diameter. Depth of borings varies with auger sizes and earth formations. Six in. to eight in. augers can drill to depths of 125 ft in earth, clay, compacted sand and gravel, hardpan, shale and sandstone formations. With 12 in. to 16 in. augers Heavy-Duty McCarthy Verticals will drill 60 ft to 70 ft in earth, clay, compacted sand and gravel, hardpan and soft shale formations. Augers of 20 in. and 24 in. diameters are used successfully to depths of 16 ft to 30 ft in earth, com-



Heavy Duty Drills

(*Continued on page 128*)



JACKSON
MULTIPLE
COMPACTOR

FAST, COMPLETE COMPACTION OF 12" MACADAM BASE COURSES

Specified density of base courses of rock, slag, soil-bound macadam, gravel and sand up to 12" thick is achieved in jig-time with the JACKSON MULTIPLE VIBRATORY COMPACTOR. Frequently no more than one pass is required. Likewise, one pass suffices to solidly fill all voids from top to bottom when sufficient dry fines have been spread. With a standard width of 13', 3", working speeds up to 60 FPM and reverse travel of 5½ MPH, this machine offers single course compaction at its best — tremendous opportunity for time-and-money savings.

GRANULAR SOIL SUB-BASES — PAVEMENT WIDENING

It is equally advantageous in compacting granular soil sub-bases. And by towing the compacting units in tandem at the side of the tractor, any granular material used in flexible base course widening can be compacted to specified density in one pass.

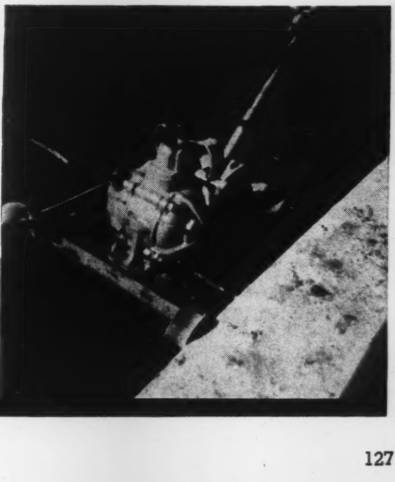
LARGE AREA FILLS: Nothing approaches the efficiency and convenience of this machine in compacting granular soil fills such as bridge approaches, sub-bases for large concrete floors, parking lots, etc. It quickly achieves desired density and individual units may be sub-contracted and even fitted with operating handles to suit every condition and to get into the really tight places. Interchangeable bases 12" to 26" in width, are available.

IN TRENCHES — CLOSE TO FOOTINGS, ETC.

The manually-guided, self-propelling JACKSON COMPACTOR (similar to one of the compacting units used in the MULTIPLE, fitted with operating handle) has proved exceedingly successful on thousands of granular soil compaction jobs and is widely used for bituminous pavement patching. Operated from a Jackson Power Plant on auto trailer having quick pick-up device for loading and carrying Compactor.

See your
JACKSON DISTRIBUTORS
or write us for complete information.

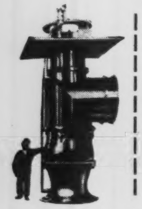
JACKSON
VIBRATORS, INC.
LUDINGTON, MICHIGAN



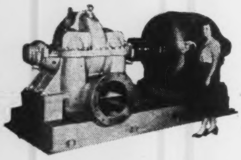
YOU NAME THE PURPOSE
WE MAKE THE PUMP

For every specific need from the smallest to the giants of 200,000 GPM capacity — Highly specialized engineering and manufacturing for over 40 years assures freedom from maintenance worries — Many users report 15 to 20 years service without replacement of major parts.

WHEELER ECONOMY PUMPS

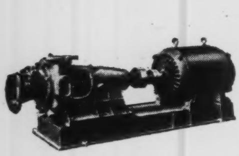


VERTICAL AXIAL FLOW FOR CIRCULATING CONDENSER COOLING WATER

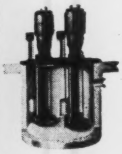


DUAL VOLUTE FOR MUNICIPAL WATER WORKS

WHEELER ECONOMY PUMPS

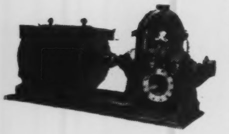


HORIZONTAL NON-CLOG FOR SEWAGE, TRASH, STOCK

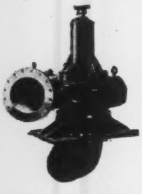


DUPLEX, SUBMERGED NON-CLOG FOR SANITATION SEWAGE, INDUSTRIAL WASTE

WHEELER ECONOMY PUMPS



TWO-STAGE DMD HIGH HEAD FOR MUNICIPAL & INDUSTRIAL SERVICE



VERTICAL MIXED FLOW FOR IRRIGATION, DRAINAGE, FLOOD CONTROL, SEWAGE

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EQUIPMENT MATERIALS and METHODS

(continued)

pacted sand and gravel and hardpan formations. The drill has two power output shafts: the high speed shaft which will handle 8 in. diameter augers and under and the slow speed shaft which will handle augers over 8 in. diameter, at half speed. Contractors, reporting drillings up to 800 ft per day varying with the conditions, are using the McCarthy on highway and turnpike surveys. The drills, highly portable, are powered by gasoline, diesel or electric motors. **The Salem Tool Company, CE 5-127,28, 700 So. Ellsworth St., Salem, Ohio.**

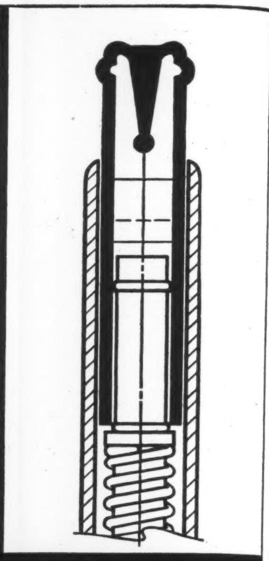
Vibratory Compactor

A VIBRATORY COMPACTOR FOR PAVING OPERATIONS ENABLES A CONTRACTOR TO GET UNIFORM COMPACTION to specified density on macadam base courses, gravel subbases and soil cement bases. The pentrating vibration of the six individual shoes makes it feasible to lay and compact bases up to 12 in. thick in one course. The vibrator also "runs in" screenings to the full depth of macadam bases even ahead of the vibrating shoes. Vertical packing action eliminates "shoving" on difficult materials. The full vibrating width with six shoes is 13 ft 1 in., but the operator alone can fold one or both of the end shoes for a narrower working width or highway clearance. **Roadequip Manufacturing Co., CE 5-128, R. D. #2, Willoughby, Ohio.**

6 Shoe Compactor

Bonding of Aluminum Alloys

ALUMINUM QUARTER-CASTING AND QUARTER FORGING METHOD AND THE BONDING OF ALUMINUM ALLOYS IS AN ENTIRELY NEW APPROACH to the reduction in costs of oversize aluminum forms such



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EQUIPMENT MATERIALS and METHODS

(continued)

as frame-members, bridging-supports, those employed in the aircraft, materials-handling, industrial, building and many other industries. This method enables the production of sections or segments, of the Quarter-Casting by any number of small foundries or shops, who in turn, can produce and deliver the sections or segments to the prime contractor, who will serve as the assembler and bonder of the finished Quarter-Casting. Strengthwise, the joining or bonding areas are so designed as to contain a two-hundred percent (200%) joining or bonding area, by virtue of the Dove-Tail anchoring and bonding surfaces. The highest temperature bonding metal, having a tensile strength of 40,000 to 45,000 psi, and the linear area of the Dove-Tail surfaces having 200% of the actual cross area, makes possible bonding strengths of 80,000 to 90,000 psi. **Precision Electronic Research Co., CE 5-128-9, Glendora, California.**

Aluminum Insulation

SHEETS OF MULTIPLE ACCORDION ALUMINUM AND FIBER DRASTICALLY RETARD HEAT-FLOW by convection. Their surfaces have a very high 97% reflectivity and a low 3% absorptivity for heat rays. Because of the insulation's thick air spaces, it is a poor conductor of heat. Being a genuine self-contained vapor barrier, the aluminum sheets have almost zero permeability to water vapor, warm and cold air. Infiltration under the flat stapled flanges is slight. The insulation comes in continuous lengths up to 750 ft without the usual insulation break. Edge to edge, the aluminum insulation gives full, uniform-depth protection between joists, against heat loss, heat intrusion and vapor flow. **Infra Insulation, Inc., CE 5-129, 525 Broadway, Dept. (A), New York, N. Y.**

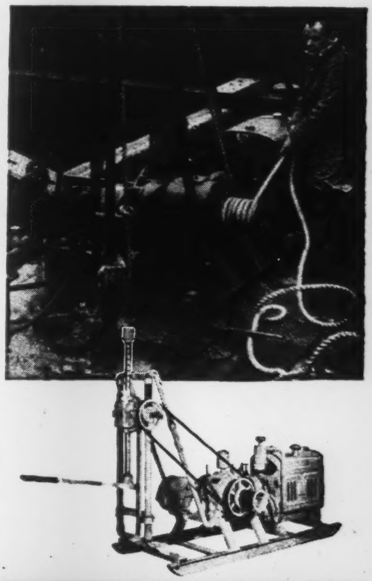
Self-Reducing Plane Table Alidade

THIS INSTRUMENT ELIMINATES THE USE OF THE SLIDE RULE, OFFSET SCALE AND DIVIDERS. Horizontal distances, measured directly with the reducing telescope, are transferred with a parallel plotter. A 27x, AR coated telescope embodies distance and height curves, fixed eyepiece and upright image. Actual working experience shows that time in the field is cut by 50%. **Kern Instruments Inc., CE 5-129, 120 Grand St., White Plains, N. Y.**

(*Continued on page 130*)

acker **Portable, Power Operated Soil Sampling Rigs**

Acker power operated soil sampling rigs combine into a compact, portable unit a standard power plant together with powerful hoisting winch and pump. Two models are available—Acker Model RGT for light duty and Acker RG for heavy duty service. These relatively inexpensive units are ideal for soil sampling, jetting and driving pipes or piles.



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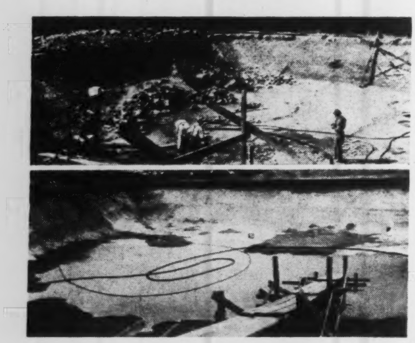

A major failure in a water reservoir serving a Virginia city left the city without storage facilities. Leakage had undercut a portion of the sides and bottom.

This area was chipped out and the cavity filled with sound, broken concrete and grouted with "Gunite". All other disintegrated concrete throughout the reservoir was removed by chipping and was discarded. These areas were restored to their original lines and an entirely new 2-inch reinforced "Gunite" lining was then applied. The lower photograph shows the completed reservoir ready to place into service just 28 days after our forces started to work.

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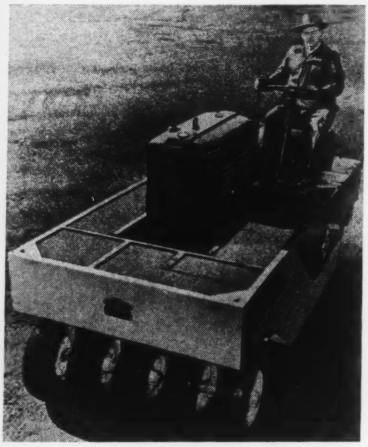
EQUIPMENT MATERIALS and METHODS

(continued)

Self-Propelled Roller

SMOOTH HANDLING AND FULL OSCILLATION ARE TWO OF THE MAJOR FEATURES OFFERED BY THE SP-54, a self-propelled pneumatic tire, 9-wheel roller. This unit is particularly suitable for mat resurfacing, seal coating and compaction jobs in the shallow lift range. It has 5 front wheels and 4 rear ones which have positive chain drive to prevent roller from getting "hung up" by a free wheel. The SP-54's torque converter drive provides even flow of power to driveline for smooth take-off in all forward and reverse speeds. Oscillation of the front and rear wheel pairs is available, which provides thorough compaction without sacrifice of tractive effort. **Wm. Bros Boiler & Mfg. Co., CE 5-130, 1057 Tenth Ave. S. E., Minneapolis 14, Minn.**



SP-54

Midget Transit

A SERIES OF OPTICAL MIDGET TRANSITS HAS BEEN MADE AVAILABLE by the Aksania Werke AG of Berlin. The reading of both circles of the transit from one position gives an accurate estimation of one minute, six seconds. A flashlight attachment enables night or underground work. This instrument weighs only $4^1/_2$ pounds, which makes it possible to carry the transit on the tripod. Its price is $595.00. Repairs are made in the United States. For a ten day trial or more information write to: **Geo-Optic Company, Inc., CE 5-130, 170 Broadway, New York 38, N. Y.**

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- With Lincoln Idealarc, you can simplify maintenance and construction and cut welding costs because:

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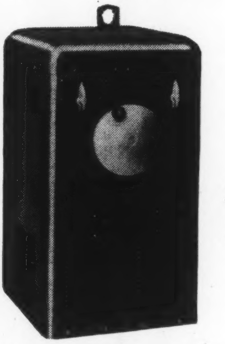

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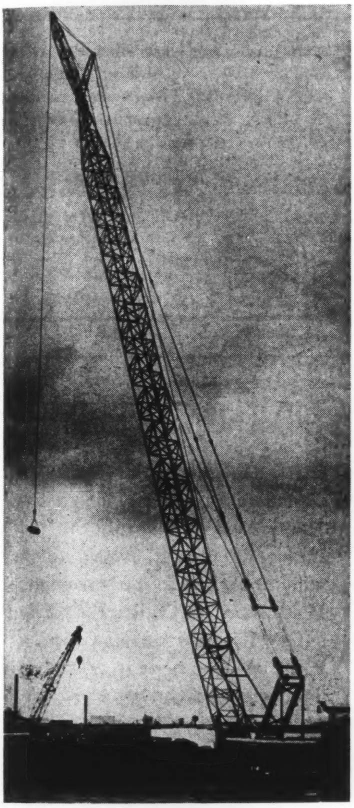
EQUIPMENT MATERIALS and METHODS

(continued)

230 Ft Boom

THIS MIGHT BE THE LONGEST BOOM EVER MOUNTED ON A CRAWLER MACHINE. There is 190 ft of main boom and a 40 ft jib, giving a total length of 230 ft. The machine handles a $1^1/_2$ yd concrete bucket on 190 ft through a radius of 80 ft, or a 1 yd concrete bucket on 230 ft at a radius of 90 ft. The extra-long boom is constructed of welded alloy steel aircraft tubing. P&H friction-free Magnetorque swing makes this possible. This machine (Model 955-ALC) is one which is being used to pour concrete for a large low-rent housing project on New York's East River. **Harnischfeger Corporation, CE-5-131, 4622 W. National Ave., Milwaukee 46, Wisconsin.**



Model 955-ALC
Crawler-Mounted Boom

(*Continued on page 132*)

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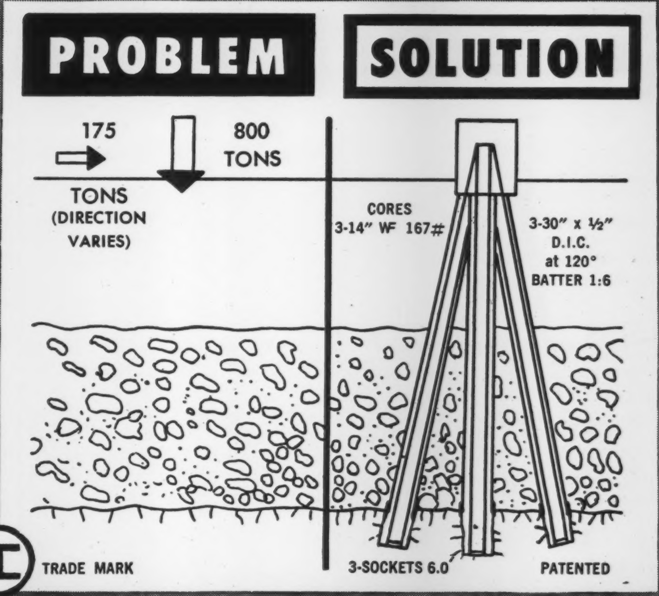
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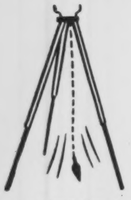
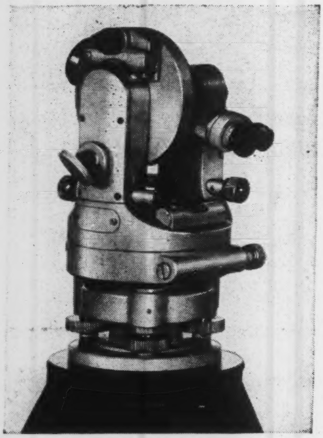
SURVEYING NEWS

NEW THEODOLITE SETS UP QUICKLY, EVEN IN THE WIND



Has this been your problem? Now—old-type mechanical plumb-bob replaced by can't-miss optical principle



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EQUIPMENT MATERIALS and METHODS

(continued)

Hydraulic Hose for Power Grader

Hydraulic hose is an integral part of the successful operation of the 88-H power grader manufactured by the Austin-Western Company. Hose transmits controlled power by hydraulic fluid so that the blade, snow-plow or other attachments can be manipulated from the cab through valves and cylinders. Most of the hydraulic system requires high-pressure hydraulic hose with wire braid reinforcement. However, in the return lines between the hydraulic pump and the fluid reservoir, pressures are lower. In addition to its oil-proof tube and cover which resists attack from the hydraulic fluid and oil and grease, Versicon has a rayon braid reinforcement permitting pressures up to 250 psi or four times the working pressure in the return lines. Austin-Western's use of Versicon in the hydraulic control system of the 88-H grader is one of the first uses of this type of hose in a hydraulic application. **The Thermoid Co., CE 5-132, 400 Whitehead Rd., Trenton 6, N. J.**

Equipment, Materials and Methods News begins on page 126

Motor Scraper

To meet the needs of the construction industry for more power, a motor scraper, the TS-360, has 15 cu yd struck capacity, 20 cu yd heaped capacity and features a new 280 hp. diesel engine. This engine offers more rim pull at all speeds for better loading, hauling and spreading performance; plus faster acceleration, easy shifting and quick getaways. Gears, shafts and bearings have been re-engineered to assure greater durability. Final drive gears are larger and heavier and tooth design has been changed to provide more even tooth loading. One of the fundamental changes in this motor scraper is the introduction of a new tractor main frame which makes possible many advantages of "unit construction." This facilitates removal and servicing of both major and minor assemblies in the TS-360. Selective steering and double-safety air brakes are two other operating advantages of the TS-360. **Allis-Chalmers Manufacturing Co., CE 5-132, Tractor Division, Milwaukee 1, Wisconsin.**

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FILMS AVAILABLE

"MOVEMENT IS LIFE"—Another then-and-now movie shows how much controlled movement has effected the development of civilization. Primitive methods of handling, such as those used in ancient pyramid-building, are contrasted with the modern mechanized movement, the automatic and mechanical handling in industry, mining, warehousing and on the farm. Emphasized in the film, however, is the scope and variety of jobs done by conveyors. The script shows how mechanical handling by conveyors may increase employment and profits and raise the standard of living. Credits for the 20-minute film go to Erik Cripps for script and direction, Biofilms of New York for production, and the Conveyor Equipment Manufacturers Association of Washington, D. C. for sponsoring it. It may be borrowed from **Modern Talking Picture Service, CE 5-133, 45 Rockfeller Plaza, New York, N. Y.**

"GLASS AND YOU"—From the beginnings of glass as volcanic matter 750 centuries ago, this documentary film covers its history and includes the creation of the 200 inch Mt. Palomar telescope mirror. The film highlights many recent developments in the field of glass manufacture, including borosilicate glass for chemists, strengthened and heat-resistant houseware, improved television picture tubes, fluorescent lamps and glass doilies made of chemically-etched glass. It not only shows the contributions glass has made to science and industry, but also to history and art. There are examples of Egyptian costume jewelry, Aztec ceremonial vessels and mirrors, the "Beacon Street Windows" in Boston and such architectural applications of glass as the United Nations building in New York. "Glass and You" was produced by Paul Hance Productions for Corning Glass Works. It may be obtained from the libraries of **Association Films, Inc., CE 5-133, Ridgefield, N. J. (Broad at Elm); Chicago (79 E. Adams St.); Dallas (1108 Jackson St.); San Francisco (351 Turk St.).**

"SPEAKING OF WIRE ROPE"—Of the many products of steel, none are more versatile than wire rope. And few are less well known. This Technicolor production, filmed all over the United States depicts the varied uses of wire rope. Using an entertaining human interest circumstance, "Speaking of Wire Rope" explains the phases of the manufacture, use and maintenance of wire rope in a way that is acceptable to engineer and understandable to the layman. From a training room, through various stages of wire drawing, stranding, and rope laying, one travels the length of the nation to watch the sinews of steel at work. **New York Film Distribution Center, United States Steel Corporation, CE 5-133, 71 Broadway, New York 6, N. Y.**

AUTOMATIC
Sewage Regulators

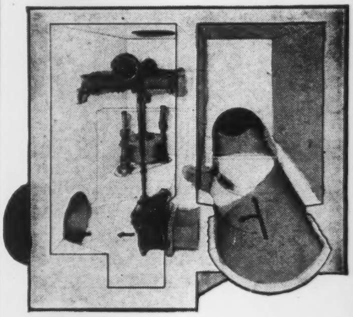

Fig. B-19

Automatic Sewage Regulators control sewage flows either by partially or completely cutting off such flows to suit head or tail water conditions or by "governing" to discharge a predetermined quantity regardless of head or tail water conditions.

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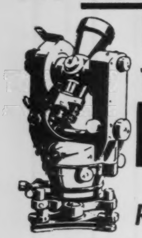

The NEW 20" Reading WILD® HEERBRUGG T-1 OPTICAL *Repeating* TRANSIT

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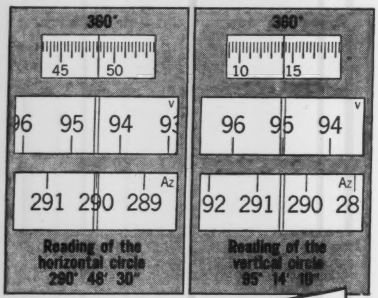
360°
45
50
96
95
94
93
291
290
289
Az
V
Reading of the horizontal circle 290° 48' 30"
360°
10
15
96
95
94
92
291
290
28
Az
V
Reading of the vertical circle 95° 14' 10"

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FIRST ALLIANCE OF MAJOR MASONRY PRODUCERS: Leaders in heavy construction industry form the Allied Masonry Council: their purpose is to help build "better buildings of better quality at lower cost". Supporters and creators of the AMC are the Structural Clay Products Institute; Marble Institute of America; Indiana Limestone Institute; Building Stone Institute; Mason Contractors Association of America, and the Bricklayers, Masons and Plasterers International Union of America, AFL . . . A **"CINDERELLA" PRODUCT:** That's what J. E. Buchanan, head of the Asphalt Industry, labels asphalt, "the greatest unrealized potential". At the annual Texas meeting he urged oil men to promote petroleum asphalt for highway paving . . . **1,300,000 CUBIC YARDS OF EARTH:** To build a $23 million ammunition loading dump for the Army Corps of Engineers in Wilmington, N.C., Hertford & Cecil Construction Co. are doing the earth-moving with the help of International equipment. Between railroad track spurs they are piling up 16-foot high earth barricades to keep the entire yard from blowing up in case of explosion . . . **LONG SAULT DAM CONTRACT:** The Power Authority of the State of New York chooses a $25,972,033 bid for the construction of this St. Lawrence Power project dam. In a five-firm joint venture, New York's Walsh Construction Company offered the lowest of the eight bids submitted. Long Sault Dam, which will close the south river channel, is the first of three dams to be constructed at the power project site . . . **N. J. POWER & LIGHT CO. CONTRACT:** Walter Kidde Constructors, Inc. of New York and Houston receives the design and construction contract for the office and service building at Denville, N.J. The million-dollar project is scheduled for completion in one year . . . **MINNESOTA-MAINE MERGER:** The American Hoist & Derrick Co. of St. Paul acquires the Thomas Laughlin Company of Portland. This will enable American Hoist to offer a complete line of fittings and wire rope accessories from a single source . . . **NICKEL-PLATING CONTRACT:** Bart Manufacturing Corp. of New Jersey agrees to electro-clad steel plate for Colorado Fuel and Iron Corp. exclusively . . . **CANADIAN SUBSIDIARY:** The Charles Bruning Company, Inc. acquires the J. Frank Raw Company, Ltd. of Toronto. This firm is one of Canada's leading paper converters and engineering supply houses . . . **KREISLER-BORG CONSTRUCTION CO.:** Robert F. Borg and Jacques Kreisler, Jr. form a new general contracting and heavy construction company which is located in White Plains, N.Y. . . . **K & E EXPANSION:** From its Hoboken plant to remodeled property in Cape May Court House, N.J., Keuffel & Esser Co. moves its entire hardware division. Known as Cape May Products, Inc., it is now manufacturing tapes in the 25 000 square foot area . . .

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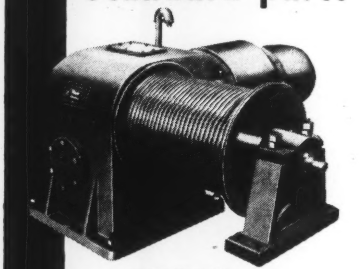

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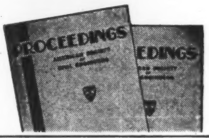

PROCEEDINGS AVAILABLE

The following papers have become available as Proceedings-Separates. Following the date of issue of a paper, discussions thereof will be received for a period of three months, as specified on the cover of the paper. Titles will be added to this list every month, as they become available. Technical Division sponsorship is indicated by an abbreviation at the end of each item, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways (WW) divisions. Papers issued prior to, and including, Separate No. 289, were not distributed under the present automatic mailing system. If you have not registered in a Technical Division to receive its papers (one Division only) free of charge, please do so promptly by filling out and mailing the enrollment and subscription form (page 137) to Society Headquarters. For ordering separate papers, use the convenient order form on page 136.

Listed in Earlier Issues

647. Discussion of Proceedings—Separates No. 454, 471, 472, 557. (SA)

648. Trussed Diaphragm in a Rigid Bent System, by Mortimer Margolin. (ST)

649. The Constant Segment Method for the Analysis of Non-Uniform Structural Members, by Walter E. Hanson and Wallace F. Wiley. (ST)

650. Bolted Connections—Research, by W. H. Munse. (ST)

651. High Strength Steel Bolts in Structural Practice, by Mace H. Bell. (ST)

652. Bending Interaction in Suspension Bridges, by Haaren A. Miklofsky. (ST)

653. Shell versus Arch Action in Barrel Shells, by Mario G. Salvadori. (ST)

654. Discussion of Proceedings—Separates No. 434, 468. (ST)

655. Job Opportunities in Sanitary Engineering, by Harvey F. Ludwig. (SA)

656. Discussion of Proceedings—Separates No. 385, 445, 475, 476. (SM)

657. Discussion of Proceedings—Separates 363, 476, 477, 499, 513, 516, 548, 550. (SM)

658. Discussion of Proceedings—Separates No. 215, 311, 513, 514, 516. (SM)

April

659. A Study of the Behavior of Large I-Section Connections, by J. R. Fuller, T. F. Leahey, and W. H. Munse, Jr. (ST) The tests reported deal with fundamental behavior of several large structural truss-type I-section tension connections fabricated with either rivets or high-strength steel bolts. Three specimens were tested: one was fabricated with hot-driven rivets; the other two were bolted. A study is made of the distribution of stresses across the critical section in the webs of the I-section members. This makes it possible to estimate the effectiveness of the component parts of each I-section in resisting the applied load.

660. Moment-Rotation Characteristics of Column Anchorages, by Charles G. Salmon, Leo Schenker, and Bruce G. Johnston. (ST) This paper presents methods of obtaining the moment-rotation characteristics of common types of light industrial building column anchorages. These characteristics are useful in methods of analysis or design, particularly where resistance to rotation may be critical to the survival of the structure under heavy lateral loads such as earthquake or blast loads. Formulation of the complete moment-rotation curve is developed in five stages. Appendices illustrate the use of the formulas.

661. Discussion of Proceedings—Separates 540, 542. (ST)

662. Trial Load Analysis of Stresses in Dams, by Otto Pfafstetter. (ST) The author presents a general analytical proof for the trial-load method of analysis of stresses in concrete dams. The presentation endeavors to confirm the validity of the use of the principal systems in the trial-load analysis—namely, vertical cantilevers, horizontal arches or beams, and the twisted structure. The general equations developed for arch dams are simplified for the particular analysis of straight gravity dams having grouted and ungrouted joints. The use of self-balancing loads and the use of twisted structures in performing the analysis are presented separately.

663. Lateral Bending of Suspension Bridges, by Cevdet Z. Erzen. (ST) In this paper is studied the lateral bending of a suspension bridge under the combined influence of the stiffening truss and the cable. Difference equations are used to solve the problem. The method of solution is direct, and it takes very little time to perform the numerical computation.

664. Discussion of Proceedings—Separates 430, 441, 468, 541, 561. (ST)

665. Discussion of Proceedings—Separates 383, 413, 431, 433, 438, 439, 536, 624. (HY)

666. Tide Heights along the Coasts of the United States, by L. P. Disney. (HY) Elevations of extreme tides and secular variations in sea level are important factors in the

INSTRUCTIONS

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design of coastal installations. Tables are given which list the highest and lowest tides recorded at several control tide stations. Illustrations of the yearly and secular variations in sea level for some stations on the Atlantic, Gulf, and Pacific coasts are presented.

667. Scale Relations Among Sand-Bed Rivers Including Models, by Thomas Blench. (HY) The author discusses the value and practicability of model simulation of the water-sediment complex of sand-bed rivers. The origin of regime-theory formulas and their application to rivers are then explained, and an example is presented of their use in designing the initial scales of a model that possesses a bed load of natural river type. The author recommends the control of important models by a panel representing a variety of skills.

668. Mechanics of Streams with Movable Beds of Fine Sands, by Norman H. Brooks. (HY) The characteristics of streams flowing over a loose bed of fine sand were studied in order to determine what factors govern the equilibrium rate of transportation of fine sand in suspension. Twenty-two experimental runs were performed for various conditions in a 40-ft tilting flume. By using the mean velocity and the depth (or the water discharge and sediment discharge) as independent variables and the slope as a dependent variable, an orderly qualitative relationship between the pertinent variables was obtained.

669. Salt Water Encroachment into Well Water in the Miami Area, by Earle M. Rader. (HY) Unwise drainage works partly depleted the ground-water supplies of the Miami area and led to intrusion of sea water. Projects of the Dade County Water Conservation District, the Central and South Florida Flood Control District, and the Corps of Engineers have largely cured this trouble, assuring ample supplies of good water for the future.

670. Virtual Mass and Acceleration in Fluids, by T. E. Stelson and F. T. Mavis. (EM) Measurements were made on objects whose largest dimension was from 2 to 20 in. as they were immersed in water and accelerated in oscillatory motion. The added masses, which depend on the size and shape of the body, the direction of acceleration, and the density of the fluid, were determined from a mass-frequency relationship for the supporting beam. The experimental results are reasonable and consistent and agree with previous analytical studies of potential flow.

671. A Resistor-Network Solution for the Elasto-Plastic Torsion Problem, by J. H. Weiner, M. G. Salvadori, and V. Paschkis. (EM) A method of solution using a resistor network is presented for the torsion of a perfectly elasto-plastic cylinder. The finite-difference approximations customarily used in the relaxation procedure are made, but the relaxation is accomplished automatically by the network. Once the network for a given geometry is set up, a complete torque vs. twist curve may be obtained in a short time.

672. On the Lateral Stability of Multi-Story Bents, by E. F. Masur. (EM) A numerical method is described which makes it possible to determine the stability of multi-story bents subject to sidesway without the solution of the classical transcendental equations. Through the use of moment-distribution techniques, which are familiar in conventional structural design problems, the desired safety factor is boxed in between upper and lower bounds. Through a repetition of the procedure, the gap can be narrowed down to within any required degree of accuracy.

673. Lateral Buckling of Elastically End-Restrained I Beams, by W. J. Austin, S. Yegian, and T. P. Tung. (EM) The purpose of the paper is to present the critical lateral loads and the corresponding critical bending stresses at midspan for prismatic I-beams having equal linear, rotational restraints at both ends. In practical structures such end restraint is commonly provided by the connections. It is important to determine the increase of the lateral buckling load which results from this restraint.

674. Failure of Plain Concrete under Combined Stresses, by Boris Bresler and Karl S. Pister. (EM) The initial phase of an investigation of the failure of plain concrete under combined stresses is presented. Previous investigations of the failure of plain concrete reveal that the correlations of various criteria with test data have been either inadequate or inconclusive. To obtain further evidence on failure of plain concrete, hollow cylinders were tested under varying combinations of torsion and compression. Data obtained from these tests indicated a correlation between normal and shearing octahedral stresses at failure.

675. Plastic Deformation of a Beam under Impulsive Loading, by B. A. Cotter and P. S. Symonds. (EM) The deformation of a free-free beam subjected to a symmetric impulsive loading is investigated by means of a plastic-rigid analysis. The range in which the complete plastic-rigid analysis can be expected to be valid is apparently different from that in which the single-hinge type of elastic-plastic analysis is accurate, the former giving reasonably good results for the central angle only when the initial velocities are sufficiently large, and the latter applying particularly to low velocities. At low velocities both the single-hinge analysis and the complete plastic-rigid solution involve appreciable errors.

676. Impulsive Motion of Shear Buildings Including Plasticity and Viscous Damping, by Edward Cohen, Leon S. Levy, and Leonard E. Smollen. (EM) The method of normal modes is applied to the analysis of elasto-plastic shear buildings subjected to impulsive loads, foundation uplift and non-uniform viscous damping. Interaction of foundation rotation and plasticity in the superstructure are described. A short table of approximate modes and frequencies is included.

677. Vessels Partially Supported by Soil, by W. A. Boothe, R. T. Gray, and G. Horvay. (EM) Curves are plotted which indicate the reduction in bending stresses that can be achieved near a discontinuity in a cylindrical shell by application of partial elastic support in the vicinity of the discontinuity.

678. A More Simplified Venturi Tube, by J. C. Stevens. (HY) The paper shows that a Venturi Tube can be made of standard AWWA reducers, resulting in little more loss of head than is observed for the Herschel or shorter tubes. There is no appreciable loss of accuracy as accuracy is largely a matter of calibration. The use of water instead of mercury in manometers has the advantage of materially reducing velocities through reducer, throat, and diffusor because it is not necessary to reduce the throat to obtain a readable differential of mercury.

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